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NOTES

ON THE

Agricultural Conditions and Problems

OF THE

UNITED PROVINCES

and of its districts

BY

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DISTRICT NOTES OF—

Dehra Dun.
Saharanpur.
Muzaffarnagar.
Meerut.
Bulandshahr.
Aligarh.
Muttra.
Agra.
Mainpuri.
Etah.
Bareilly.
Bijnor.
Budaun.
Moradabad.
Shahjahanpur.
Pilibhit.

Farrukhabad.
Etawah.
Cawnpore.
Fatehpur.
Allahabad.
Jhansi.
Jalaun.
Hamirpur.
Banda.
Benares.
Mirzapur.
Jaunpur.
Ghazipur.
Ballia.
Gorakhpur.
Basti.

Azamgarh.
Naini Tal.
Almora.
Garhwal.
Lucknow.
Unao.
Rae Bareli.
Sitapur.
Hardoi.
Kheri.
Fyzabad.
Gonda.
Bahraich.
Sultanpur.
Partabgarh.
Bara Banki.

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PROVINCIAL NOTE.

I HAVE attempted to make the district notes complete in themselves as regards all the more important subjects on which information is available, but they would become inconveniently long if they were to include discussions of every point that has arisen in connection with a number of districts. I have therefore put together the following note for the province as a whole, as supplementary to the district notes, and as indicating the need for investigation of particular matters concerning more than one district.

I.—Masonry wells.

It will be convenient to bring together the results of the enquiries made regarding the possibility of increasing the number of masonry wells.

(*a*) Almost every district where spring wells are practicable has room for many more than exist.

(*b*) Where the practice of sinking wells is established, the local knowledge as to the presence of a stratum of foundation-clay can usually be relied on: elsewhere facilities should be provided for trial-borings.

(*c*) Where foundation-clay is believed by the people to be absent, it is worth while to arrange for borings to determine whether it exists at a depth greater than has been explored. If it is found, "semi-artesian" wells of the type described in the Manual of Irrigation Wells can be constructed. If there is no foundation-clay within reach, only percolation-wells can be constructed.

(*d*) There are extensive tracts, especially in the north-east of the province, where masonry percolation-wells are fairly efficient, though they cannot as a rule yield the same supply as spring wells and therefore protect a smaller area, besides being more liable to failure.

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It is not possible at present to make definite recommendations regarding the construction of such wells in places where the people now rely on temporary wells: the question of cost and advantages must be worked out in accordance with the local conditions; but it may be suggested that as the cost of labour rises the introduction of masonry linings will tend to become advantageous. Should the agricultural department succeed in devising a form of percolation-well which can be constructed at moderate cost, without specialised skill, and of materials available in the villages, the whole position will be altered, and it will be desirable to arrange for the construction of demonstration-wells of the approved type in all the principal tracts that at present rely on percolation supplies.

(*e*) Where masonry spring-wells are possible and are still required, the most important point is to bring home to the people that Government is anxious to see the wells made and is prepared to find the capital that is needed. Considerable progress has been made in this direction in recent years, but steady effort and constant repetition are required to make the people realise the position.

(*f*) Apart from the supply of capital, perhaps the most important factor is the attitude of the landholders, which varies within very wide limits. On the one hand there is the landholder who takes active measures to secure that wells are made wherever they are wanted, either constructing them at his own cost, or making the tenants construct them and assisting with the loan of capital and the supply of wood for fuel. This class is represented by not a few of the large landholders as well as by the Court of Wards. At the other extreme are the landholders—happily few—who object to seeing a tenant sink a well and who will not sink wells themselves. The majority of the landholders come between these extremes: some are benevolent but inactive, some neutral, and some inclined to raise obstacles; and the district administration can do much in the way of influencing the individual members

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of this large intermediate class. The information collected shows that the attitude of landholders has on the whole improved during the last five years, but here again steady pressure and constant repetition are required to secure the object of Government, that wells should be made wherever they are wanted.

(*g*) An obstacle very commonly interposed in Oudh is the practice of requiring a tenant to relinquish his claim to compensation on ejectment as a condition of the grant of permission. Such a condition necessarily discourages construction: many wells are made under it by tenants who trust their landholder, but many more would be made if the condition were not imposed. The extent of the practice may be judged from the fact that the Board of Revenue has found it necessary to prohibit its adoption in particular cases in estates that have come under the Court of Wards; that is to say the local authorities have regarded it as a normal feature of estate-management. It is probable that the tenants' relinquishment would be held by the courts to be inoperative, but such a decision if given would not be of widespread application since the landholder's consent is rarely given in writing, and proof of written consent is necessary to establish a claim to compensation. The provisions regarding improvements will doubtless be reconsidered when the question of amending the Rent Act arises.

(*h*) The supply of water in spring wells is not always adequate. In some cases this defect is remediable, and the supply has been greatly improved in a large majority of the attempts by sinking a pipe through the bottom of the well to a spring underlying a lower stratum of clay.

In other cases the deficiency is due to the stratum of foundation-clay being too thick to be pierced by the tools at the cultivator's disposal. In these two cases, facilities for boring should be provided.

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(*i*) It is probable that in many cases existing wells could yield a much larger supply of water than can be obtained from them by the methods now used: and that with improved methods of raising water the diameter of new wells, and therefore the cost of construction, could be very greatly reduced. The adaptation of power-pumping to the conditions should therefore be regarded as one of the most urgent problems before the agricultural department.

(*j*) A problem of lesser urgency, but one which should be worked out, is the most economical methods of distributing the water raised. A very large proportion of the water is lost by evaporation and percolation while passing along the earthen channels on its way to the field, and it is quite possible that with a continued rise in cost of labour and cattle-power it will be found economical to adopt some form of piping or lining, at least for the longer channels and in the more porous soils. Even now channels lined with roof-tiles may occasionally be seen; and though the capital-cost of regular piping is probably prohibitive, it may be possible to design forms that can be made by the village artisans.

II.—Field-embankments.

The need for field-embankments arises where a soil naturally retentive of moisture but not easily irrigible lies on such a slope that much of the rain water runs off the surface. When the rains cease early such land will be unfit for rabi cultivation, though it would often be perfectly fit if it had been allowed to absorb a larger proportion of the rain that had fallen. An embankment across the slope effects this object: and where irrigation is not feasible it is the only means of protection that can be suggested. An additional advantage is that the surface of the land so embanked is protected from the scour of running water which removes portions of the fertile soil; while when the practice is systematically adopted, the development of ravines in the lower slopes will probably be checked.

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Field-embankments.

The construction of small embankments of this kind is best effected by the people: Government assistance is required (1) in providing capital, (2) sometimes in laying out the work with due regard to levels, (3) in constructing demonstration-embankments in localities where the people are unacquainted with the practice. In addition, a certain amount of pressure is required to contract the tendency of the people to put off such enterprises till a dry season comes: recent experience is to the effect that embankments are readily made during and just after a famine, but that the impetus dies down when times of prosperity recur. For the larger embankments some skilled supervision is desirable to prevent work being wasted.

The chief scope for these works is in the black soil tracts of the Jhansi division and the Allahabad district: in all of these districts considerable progress has been made in recent years but there is still room for very many more embankments. It is probable, though the question has not been fully studied, that such works would prove of great value in the unirrigated tracts of mixed soil along the Jumna and Ganges, and it is desirable that these tracts should be examined by an officer familiar with Bundelkhand practice, and that a few demonstration-embankments should be constructed by Government in each tract found suitable.

The tracts that might be examined are:—

Agra	... Tahsil Bah.
Etawah	... The *ghar* and Jumnapár tracts.
Cawnpore	... The Jumna tract. (The Collector has recently pressed for the construction of a few embankments here.)
Fatehpur	... The Jumna tract.
Allahabad	... Pargana Atharban.
Benares	... The Karail soil tracts in Chandauli tahsil.
Ghazipur	... The Karail soil tracts south of the Ganges.

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III.—Embankments for late rice.

Where canal water cannot be made available, the only hope of saving any part of the late rice when the rains cease prematurely lies in embankments across the drainage lines; and such works are useful in all but the wettest seasons in affording supplies for a final irrigation to the crop in their vicinity, and sometimes in enabling a rabi crop to be sown after the rice is harvested. Their value is recognised by the people, and large numbers are in existence. The question whether they can be increased in number and improved in design does not appear to have been studied, and it is suggested that this question should be taken up, and the conditions of one or two of the most important tracts examined in detail to see if extensions or improvements are possible and to propose measures for carrying out such works as are desirable. The tract including pargana Ungli in Jaunpur and a large portion of Deogaon tahsil in Azamgarh would be specially suitable for such an investigation; it is exposed to the risk of severe distress when the late rice is lost. Experience gained in the study of one such tract could then be applied to the others: the districts chiefly concerned are Fatehpur, Allahabad, Benares, Mirzapur, Jaunpur, Ghazipur, Ballia, Azamgarh, Rai Bareli, Fyzabad, Sultanpur and Partabgarh.

The area of late rice is important also in Gorakhpur, Basti, Kheri, Gonda and Bahraich, but the conditions are somewhat different and conclusions could not be applied so directly in these districts as is the case south of the Gogra. In some of them embankments will probably be found suitable, while in others the utilisation of streams is a more likely method of protection.

IV.—Drainage.

There is comparatively little of general interest to be said under this head. The country served by canals is looked after by the Irrigation department, the jurisdiction of which

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is extending as new irrigation projects are carried out; and beyond their jurisdiction little fresh light has been thrown on requirements during the recent series of dry seasons.

Broadly speaking, the natural drainage of the Ganges-Gogra doab is unsatisfactory. Only a very small portion of this area drains direct into those rivers: the main drainage-lines, the Gumti, Sai, Tons, &c. are unable to carry off all the surface-water that reaches them after heavy falls, and cannot take largely increased supplies and in the intervening stretches of heavy clay the surface-water collects in the *jhils*, and either evaporates or is used for irrigation. After wet seasons a demand for the drainage of these tracts usually arises, but it is never unanimous, and it dies away when dry seasons recur. At the present time any proposals for drainage would probably be most unpopular: but in the event of canal-irrigation being introduced into this doab, the question of drainage will require the most careful consideration, and free use should be made of any available district records regarding the position in the years 1893 to 1895, when the area covered by water reached a maximum.

Some of the larger light-soil tracts, notably the Rohilkhand *bhur* and the land along the Kali Nadi in Etah and Farrukhabad, present exactly opposite conditions.

In them an unusually large proportion of the rainfall sinks into the ground, instead of flowing oft or collecting in surface depressions, and experience indicates that the subterranean movement of water towards the drainage lines proceeds very slowly. A series of wet years tends to raise the water-level in such tracts to a point that prevents profitable cultivation, and deterioration may be exceedingly rapid: while on the other hand the retention of such rain as falls gives these soils unexpected resisting power in dry seasons. The Kali Nadi tract is under the observation of the Irrigation department, and drainage-works have been carried out, but it cannot be said that they have been fully tested by a series of wet seasons. In the event of surface-water in any part of the Rohilkhand *bhur* being increased by the construction of the Sarda-Ganges canal, very careful attention should be given to this tract, or there is a distinct danger that the experience of the Kali Nadi tract may be repeated. Even if the canal is not made, it is most desirable to maintain regular observations of the water-level in wells at intervals along the tract, and when a distinct rise is observed to be in progress to clear out the interrupted drainage lines which exist below the *bhur* and thus facilitate escape of the water; the clearing of these lines is probably not desirable while the water level stands low.

In the remainder of Rohilkhand and Oudh and in Gorakhpur, such injury as occurs from excessive water is usually due to floods in the river-valleys, and must in existing circumstances be regarded as inevitable.

Practically the whole doab is in charge of the Irrigation department, and the only portion known to require attention is the centre of the Fatehpur district and the adjoining portion of Allahabad : the position is stated in the district notes.

In most of the country south of the Jumna-Ganges line the problem is to check rather than facilitate the movement of water. There are exceptions to this last statement; some of them are very local, but the question of controlling floods caused by the spill of rivers is of rather wider interest. Works have recently been carried out to control the spill from the Utangan in the Agra district, and it is desirable to see whether similar action can be taken] in regard to the Karamnasa and Gorai rivers which periodically send out floods across portions of Benares and Ghazipur.

V.—Ravines.

The gradual loss of fertile land caused by the extension of ravines is in the aggregate serious: the fact that the loss is gradual enables the population affected to adapt itself

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to the changed conditions, but the evil is of sufficient general importance to justify continued efforts both to utilise the land already ravined and to prevent or minimise further extensions.

To minimise extensions the essential is to reduce to the lowest possible amount the run-off from the land lying above the ravines and drainage into them. This result is attained by the field-embankments of Bundelkhand (vide section II), and their continued construction is most desirable on these grounds alone. In the rest of the provinces the land just above the ravines is as a rule unirrigable, and in accordance with the custom of the country is sown with kharif crops rather than with rabi Naturally when the rainfall is heavy, either the field boundaries break, or the cultivators cut them to save their crops, and most of the flood passes direct into the ravines; a large proportion of the extensions are thus directly traceable to the effects of sudden heavy rainfall. It is highly probable that if the border-fields were sufficiently embanked to retain the moisture and left uncropped during the rains, they could be used for rabi crops even without irrigation: but it is at least doubtful if the rabi yield so obtained would be greater than the kharif that would be sacrificed, and very doubtful if it would pay for the cost of embanking. Experiments on this point are however desirable.

An alternative method of reducing run-off is to use the land above the ravines as a fuel and fodder reserve, and there is a reasonable prospect that this will pay the landholder provided he is within reach of a market for *babul* bark, and provided he can wait for a cash return until the period when the first crop of *babul* matures.

A small experiment on these lines has been initiated by the agricultural department, and it is understood that the forest department is about to undertake further experiments. Should it be found that the practice is financially sound, the question of encouraging its extension will have to be considered. The ordinary landholder will not easily realise the advantages: on the one side he has an increase of grass, which may bring a small annual income, and a prospect of a lump sum in perhaps ten years' time for bark and wood (unless he lets his tenants have the wood and sets free an equivalent amount of manure): on the other hand he loses the rental of the land, and may have trouble in getting it out of the tenants' hands. The points to be considered by Government will be largely questions of land revenue: should the revenue of land so used be remitted, and if so should a charge be levied when the crop of wood and bark is sold: or are the advantages to the country—more fodder, more fuel, more manure, and less extension of ravines so great as to justify remission of all revenue so long as the reserve is maintained?

Wherever a reserve is established, efforts should be made to extend it as far as possible into the ravine-system: sites may often be found at the head of a ravine where when most of the run-off has been arrested by the reserve—small earthen dams can be made and grass and trees established, and a gradual extension downwards may be found possible as more and more water is arrested at and near the head. This course appears in present circumstances to be the only feasible method of utilising the ravines already in existence; the alternative of dams to collect the silt is so far as can be judged financially unprofitable because so long as the ravines receive the run-off from the upland every dam must have a masonry escape and the aggregate cost of these works would be very great.

VI.—Insect-pests.

The study of the insect-pests of the province is still incomplete, but it has progressed sufficiently far to show that as a rule there is little scope for individual action when the pests have developed, but that they can in many cases be controlled by associated action taken at the right season.

The following notes deal only with the pests which have been prominent in recent years and regarding which information is available. When other pests are reported, the facts should be communicated *without delay* to the department of agriculture.

1. *The cane hopper.*—This pest has caused serious loss in recent years throughout several of the eastern districts and in South Oudh; its most usual vernacular name is *Phangi.* It resembles a grasshopper, and appears on the sugarcane early in the rains, feeding on the leaves during July and August: when it has attacked a field in numbers the resulting injury is very serious. Practically nothing can be done when the hoppers have once entered the cane-field.

They can be caught just after birth when they usually feed for a few days in the rice-nurseries or on kharif crops that have just come up: this can be done by sweeping a bag over the place where they are feeding, and the insects caught in the bag should be thrown into a vessel containing kerosine oil and water. But a much more effective remedy is to destroy the eggs, and this can be done at any time between February and the break of the rains by turning over the soil of the fields where sugarcane has been grown; this action exposes the eggs, which are lying dormant just under the surface of the soil, and the heat of the sun will then kill them. The soil can be turned over either by a soil-inverting plough or by digging it.

To secure success it is necessary that the practice shall be adopted over all the cane-fields of the affected area, and pressure may have to be exercised on the landholders to see that this is done.

In parts of Bara Banki, and probably elsewhere, it is already the practice to dig the land daily as the sugarcane is removed from it and before the soil has hardened: this practice almost obviates the possibility of hoppers appearing in large numbers.

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Insect-pests.

Boring-insects.—The commonest of these is the *Moth-borer* (known in vernacular as *Ar* or *Dhola*, and probably by other local names). This moth lays eggs on the leaves of sugarcane, maize and juar, and the young caterpillars bore their way into the stem of the plant and live there till they turn into moths: the result of their presence is the death of the stem in which they exist. Something can be done to diminish their numbers if cultivators will cut out *and burn* any stems of these plants which show signs of being attacked, but the most effective measure is to burn all the roots and stubble of maize, cane and juar fields before the warm weather sets in. If this is done the caterpillars which are wintering in the roots and stubbles will be destroyed, and there will be comparatively few moths in the next season. In this case too associated action is required to effect a material improvement.

Bollworms.—These insects do considerable damage to the cotton crop, in all probability much more than has hitherto been reported. The moth lays its eggs on the young cotton plants, and the caterpillars bore first into the plant, then into the buds and finally into the bolls. The shoots and buds attacked wither, while the lint in the bolls is spoilt. The caterpillars are less than an inch long when full grown: when they have fed sufficiently they leave the boll and make a grey cocoon attached to it on the outside.

To control this pest associated action is required from all growers in the area affected: the best measures are:—

(*a*) From July onwards any young plants that wither should be collected and burnt.

(*b*) When picking cotton all affected bolls should be collected and burnt at once.

(*c*) The plants should be cut down and used as fuel as soon as picking is over, and if possible the fields should be ploughed and levelled: if ploughing is not possible grazing cattle should be brought on to the field as much as possible.

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(*d*) The *bhindi* crop should not be grown between March and September in areas where cotton is important, because the insect will live on *bhindi* plants while cotton is not available.

The insect is probably known by a large number of local names, but the only name in general use is the word *kira* (worm).

Aphis (Mahun).—This small green insect appears on the rapeseed crop in enormous numbers during damp and cloudy weather: it settles on the young flower-shoots and feeds on the juice of their stems, with the result that flowers do not form or if they form give very few seeds. It can be controlled by spraying, but this method is not economically possible where the crop is grown in lines or borders; it could be carried out by societies or associations in the northern districts where rape or mustard is grown as a pure crop.

Potato-moth.—This moth lays eggs on the tubers, and the larvae bore into these when the potatoes are stored, and also into the plants in the field, but the injury in store is more extensive. The most important point is to see that the seed-potatoes used do not harbour the pests, and every effort should be made to prevent growers obtaining seed from localities where the pest exists. At present large parts of Bengal and notably Patna are infected, and in these provinces Lucknow and Cawnpore; but districts where the crop is important should obtain regular information from the agricultural department as to what markets are safe and should publish this information among growers when they are beginning to make their arrangements for seed.

When the presence of the moth is reported in any locality, application should be made at once to the agricultural department, which will show the growers the special precautions that should be taken to preserve seed-potatoes. No vernacular name of this pest is yet established.

Rice sapper (*gandhi*, and other local names). This is an evil-smelling fly that sucks the juice from the flower shoots. It can be controlled by careful cultivation and removal of weeds from the field boundaries, but this may be impracticable: no remedy can be applied when once it has appeared in numbers. Its existence is a serious obtacle to the introduction of rice in tracts where the crop has not been recently grown, as the few experimental or demonstration plots are likely to be injured so severely that the crop will not be sown again.

VII.—Fungoid diseases.

These are still imperfectly known, and prophylactic measures can consequently be recommended only in a few cases.

Smut on juar, and also on oats, can be largely prevented if the seed used is treated by the methods recommended by the agricultural department.

Rust on wheat and linseed cannot apparently be prevented, and the only course is to grow varieties which are relatively immune : suitable varieties have still to be found.

Red rot on sugarcane is not common but is disastrous where it appears. So far as is known, the only course is to abandon the variety attacked, and grow one that is relatively immune.

It is most important that the occurrence of any other fungoid disease should be promptly reported to the agricultural department in order that steps may be taken for its investigation.

VIII.—Weeds.

The common field-weeds are shallow-rooted plants that are adequately kept under control by the ordinary operations of tillage, while many of those that grow during the rains are used as vegetables or as food for cattle. They may however reduce the kharif yield in seasons when continuous wet weather delays weeding; and in the lowlands they occasionally grow to such an extent on fallow land that the country plough

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rabi seed-bed. In this last case an iron plough or some other cultivating implement is a great boon, and in any case the use of better implements in these tracts will give better tillage in the limited time available.

Only two weeds, *kans* and *baisurai* are known to establish themselves permanently to an extent that interferes with cultivation: but there are probably a few other grasses which behave in the same way as *kans* over limited areas.

Kans.—This grass is to be seen in occasional plants or small patches over a large part of the country; but where cultivation is close and weeding is regularly done it has no chance of spreading to a dangerous extent; its opportunity comes when land is left uncultivated. The plant then establishes itself with a very deep and complex root-system, and the patches spread rapidly, until the ordinary country plough cannot work owing to the obstacles presented by the roots. The land then remains uncultivated until the *kans* wears out.

Kans is a danger in the light soils of the middle doab, where it has in the past spread to a large extent over land that had become temporarily unproductive owing to a rise in the water-level. It is however most dangerous in Bundelkhand and in the mixed soils lying along the north of the Jumna in the lower part of its course: and speaking generally the richer the soil the greater is the danger.

The problem of exterminating it has not been fully solved, but it appears probable that a solution will be found in the adaptation of a tillage-implement to cut through the roots until the plant is destroyed; and if this is found to be economically possible, there may be a useful field for advances to cultivators to enable them to clean their land.

The problem of preventing its extension is largely economic; its spread is least where there is an adequate population with industrious habits and sufficient resources, and

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the general policy for the improvement of Bundelkhand aims at progress in this direction.

Baisurai.—This weed is found mainly in the middle duab from the Muttra district to Etawah; but it also exists in Jaunpur, and possibly in other districts. It grows in the lighter soils and makes most of its growth in the hot weather when it sends down its roots to great depths. It thrives in dry seasons and is injured by a rise in the water-level. Tillage is not altogether prevented by the existence of this weed on the land, but the yield of crops is materially reduced. The plant has no economic value in ordinary seasons, but can be used to supplement the stock of fodder when this is very scanty; attempts to make a palatable silage from it have not as yet been successful.

The best course to eradicate the weed is to plough the land with a soil-inverting plough between February and May, and again at the beginning of the rains. This checks the growth of the weed, enables the crop sown to get a good start, and gives it a chance of smothering the weed. Action is however required for several seasons to secure eradication: the more frequently ploughing is done in the hot weather, the shorter will be the period required.

The weed is certainly extending by the natural distribution of its seed: and there is some reason to think that it is carried by the canals. Extension will be prevented if the formation of seed is checked, and this would result from the measures indicated above for extermination. It would also be very largely prevented if the people would cut the surface-growth of the weed in the hot weather before it flowers, instead of at the beginning of the rains when the seed has been distributed.

IX.—Cattle-supply.

The supply of cattle is dealt with in the note on the cattle survey.

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The question of preserving grazing-ground is before Government: the note in question indicates the principal areas in which any action that may be authorised should be carried out, as well as the areas which require a better supply of bulls.

The action required regarding cattle-disease has been indicated in the district notes.

Speaking generally, it is desirable that the district staff should pay more attention to questions affecting the supply of cattle than has been usual in the past: the prompt suppression of disease and the provision of the capital required to replace losses from disease or other causes are matters for executive action, while knowledge of the leading breeders, where they exist, will often make it possible to remove or mitigate some of the obstacles that stand in their way.

X.—Seed-supply.

Cultivators experience considerable difficulties in obtaining sound seed when the produce of the previous year has been poor in quality, and a deterioration in cropping may result from this cause: for instance when wheat has been seriously affected by rust, the following rabi will probably show a lower percentage of wheat and a larger proportion of inferior mixed crops. It is desirable that when seed-time is coming on district officers should interest themselves in the position, and should make arrangements to provide advances for the purchase of seed whenever they have reason to think that the supply is defective.

In most parts of the provinces the provision of capital should be sufficient to meet the situation, but from time to time cases may arise where the trade will not supply sound seed even if cultivators have the money to pay for it; and the probability of such an emergency should be reported to the agricultural department at the earliest possible moment, in order that a supply may be organised. When this is done,

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the seed can be advanced as *takavi* at whatever price may be determined, and no money need pass.

Similarly an early report should be made of any case in which it is found that cultivators want to change the local varieties of any particular crop. Cases of this kind have arisen in connection with sugarcane and potatoes, and are more likely to occur in connection with crops that are raised from cuttings or tubers. The cost of importing cuttings or tubers in bulk is often very heavy, particularly in the case of sugarcane when quick transit is essential, and it may be desirable to arrange for growing at first only a small area, the produce of which shall be reserved for planting in the second season: for instance a bigha of sugarcane will give cuttings for planting 20 bighas or more in the second, and for 400 bighas or more in the third year. Arrangements on these lines require co-operation among individual growers, and an existing co-operative society will usually be the best agency for making a start.

XI.—Implements and machinery.

The *takavi*-system can in many cases be so used as to facilitate the introduction of improved implements and simple machinery, the need for which increases with the cost of labour and cattle-power. The matter is simple when an applicant produces a recommendation from an officer of the agricultural department, because it may then be assumed that what he wants to buy will be suitable to his needs; and the only questions for the revenue authorities will be the sufficiency of the security offered and the instalments for repayment. When however the applicant has no recommendation, it is desirable in the present state of the trade to take some precautions against imposture, except in the case of an implement or machine which has already been used successfully in the district. The simplest course will usually be either to refer the application to the agricultural department,

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or to require the applicant to obtain a letter of recommendation before the loan is sanctioned, but allowance must be made for the position and capacity of individual applicants, some of whom may be quite competent to decide for themselves, while others may probably be in the hands of unscrupulous agents. Precautions are particularly necessary at present because a bad implement or machine will produce a prejudice against all implements or machines of the same kind.

When a loan is granted for machinery to be driven by mechanical power, the rules regarding inspection of boilers should be explained to the applicant.

XII.—Manures.

As has often been pointed out, the most hopeful line of action for making a start to improve the manure-supply is to promote the use of other forms of fuel in the cities and towns. So far as wood is concerned, the decision recently taken to endeavour to establish plantations on some of the inferior land in the plains is a step forward: as regards coal and oil their use should be popularised by local exhibitions and demonstrations, and in such other ways as may be possible. In a social change of the kind Government can do comparatively little, but the following suggestions are put forward.

(*a*) The buildings maintained by the Public Works department at stations where coal is procurable should be fitted with suitable grates, instead of the open hearths on which wood is burnt. The use of coal would thus become familiar to clerks and servants.

(*b*) The railway might undertake the retail sale of coal and coke at goods stations while the demand is small. It must be remembered that the retail coal-trade is only just coming into existence, and for the present can only serve a few of the largest towns; and coal can never become popular in a town unless it can be bought retail on the spot. It is understood that those English railways which sell coal retail

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at the country stations make a fair profit, though recent information on this point is not available; and expenditure in building up a trade would be justifiable in view of the increased business that would come to the railways.

(*c*) Arrangements might possibly be made with the leading firms in the oil-trade to stock suitable oil-stoves and oil-cookers at their numerous retail dépôts, and to endeavour to promote their sale. In England gas-companies have found a similar practice highly successful in stimulating consumption.

When it is proposed to change the sanitary system of a town, early information should be given to the agricultural department. The construction of a system of sewers, or some similar change, may involve market gardeners and potato growers in great difficulties, and the agricultural department will often be able to assist them by organising the supply of some suitable fertiliser to replace the sewage on which they have hitherto depended.

XIII.—Communications.

The cultivator requires means of access to markets within easy reach of the railway; and the following remarks indicate some of his needs in detail.

The individual cultivator in the plains (excluding Bundelkhand) is not specially anxious for a completely metalled road; he wants primarily a level road with no serious obstacles to the passage of his cart. In some places he objects to *kankar* metalling, and still more to stone, because of its severity on the feet of his unshod cattle; and where a road is metalled it is desirable to have *patris* of sufficient width to accommodate carts.

Steep gradients are the most objectionable feature of a road, because the practice of the country is to load carts fully for the level; a steep declivity leads to accidents, and a steep ascent involves overstrain on the cattle as well as a good deal of cruelty. Steep gradients are very commonly found at small bridges or culverts, and at fords or descents into river-

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valleys, and the improvement of these is most desirable; while the point should always receive attention in planning new bridges, particularly railway over-bridges where the road has to be carried to a considerable height. From this point of view the bridging of the streams and minor rivers is particularly desirable, because the fords are in many cases reached by very steep descents. Steep gradients should equally be avoided at the points where minor roads and tracks join an embanked main road.

As regards the surface of an unmetalled road, the cultivator wants it to be smooth and firm but not so firm as to get puddled in wet weather. Approximation to these requirements depends partly on construction and partly on maintenance. Where a road passes through loam and does not cross the natural flow of drainage, any pronounced elevation above the surface of the country is a mistake: the road should be very slightly convex in cross-section, earth for construction and repairs being taken from the sides and placed in the centre, thus giving shallow side-drains. On the other hand the road must not be allowed to fall below the level of the country and special repairs may be necessary from time to time to bring it up to its original level. Where however the road cuts across the natural flow of drainage, it must be embanked and adequate waterways provided: the extra cost of such a road makes it desirable to follow the watershed as closely as possible.

Where the road crosses a depression in which water may collect during the rains, it must be embanked sufficiently to avoid flooding: in this case the maintenance of the greatest possible width is desirable, and the widening of embanked roads may sometimes be a useful form of relief work.

When the road runs in loose sand, the maintenance of a firm surface is impossible: embanking does no good unless there is clay or loam just below the surface which can be used for

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the embankment; and it is best to metal the worst sandy stretches even when the rest of the road is unmetalled*.

The preservation and maintenance of the village tracks by which cultivators reach the regular roads must depend on the landholders until the financial resources of the local authorities can be very greatly increased; their chief safeguard for the present must be looked for in the gradual growth of public opinion. So long as most cultivators have to pass over these tracks in order to reach a road, it seems unlikely that the country-cart can be replaced by a lighter type.

As regards bridges on local roads, very large numbers of which are required, the difficulty is the large initial cost of a permanent masonry or iron structure. Where the need is urgent and funds are limited, district boards might be well advised to consider the expediency of constructing a temporary bridge (probably on a pile-foundation); it is believed that such bridges can be made to last for a considerable number of years, and they may contribute materially to the progress of agriculture.

The second side of the question is the connection of markets with the railway. Where the traffic is sufficient, this is obviously best secured by branch lines, or by some system of mechanical transport: it is much to be desired that the railway-administrations should experiment freely with all such systems as appear to be suited to the country, and that district boards should co-operate by adapting their roads where necessary to the needs of the system selected. But there will probably always be markets where the traffic must be moved by bullock-carts, and it is desirable, now that the cost of cattle-power is rapidly growing, that the carting should be economically done. For this purpose the country cart is unsuitable, and facilities should be given for its replacement

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* It may be suggested that the classification of roads as metalled, or raised, or unraised may mislead district boards: the road should be adapted to the soil over which it passes, and where complete metalling is impossible a good road may be maintained partly metalled, partly raised, and partly unraised.

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by a lighter build in towns and cities and also on roads from markets to goods stations where the carts have not to travel across country. Suitable types might be selected by the departments of industries and public works, and their introduction could probably be facilitated by requiring Government contractors to use them as far as possible.

The improvement of communications is mainly a question of funds. Most district boards are now working up to programmes designed, so far as funds are available, to bring their facilities up to the level of the best equipped districts; but the existence of these programmes should not be allowed to obscure the fact that the equipment of even the best districts is inadequate, and that the standard requires to be steadily raised. In the interests of agriculture it is much to be desired that when surplus funds become available for non-recurring expenditure, a substantial share should be distributed to district boards to enable them to accelerate the execution of the works on their programmes, and to undertake new works when the existing programmes are completed. It may be pointed out that while metalled roads cost in maintenance from six to seven per cent. annually on the capital outlay, the cost of maintaining bridges is very much less, ranging from one-half to one-tenth or one per cent. or even less for the large bridges; bridges therefore are works peculiarly suitable for construction from special funds.

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The cattle-supply of the United Provinces.

A.—INTRODUCTORY.

IN a note prepared for the cattle conference which was held in 1909, I suggested that a survey should be made of the breeding industry in order to ascertain the risks or drawbacks to which it is exposed and the nature of the assistance that can suitably be offered. This suggestion was endorsed in resolution no. XXVII of the proceedings of the conference, and in 1910 two naib-tahsildars, Kunwar Lal Bahadur and Munshi Muhammad Usman Khan, were placed on duty for the purpose. Between them they visited all the districts in the plains of the province, in several cases more than once, and submitted full reports on the questions requiring investigation. The following note summarises these reports, which it is not proposed to publish *in extenso ;* they will be available for reference in the office of the Director of Land Records and Agriculture. It should be added that the investigation has been made throughout in consultation with district officers, and (on special points) with the Conservators of forests and the Superintendent of the civil veterinary department.

2. In dealing with the question of cattle-supply, where detailed statistics of production are unprocurable and loose assertions are common, it is especially desirable to start with such statistical information as is available. It is indeed impossible to ascertain the number of plough cattle reared, imported, or got rid of, in a given period : but it is possible to use the facts ascertained at the cattle census to make a rough comparison between the demand for agricultural cattle and the sources of local supply. The demand in a district is

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measured approximately * by the number of ploughs enumerated, and the sources of local supply vary with the number of cows. Leaving buffaloes out of account, the following table gives for the plains districts the figures as ascertained at the census of 1908-9, together with an index number showing the number of cows per 100 ploughs :—

District.	Number of ploughs.	Number of cows.	Number of cows per 100 ploughs.	Remarks.
1	2	3	4	5
Saharanpur	87,370	130,108	149	
Muzaffarnagar	64,339	83,648	130	
Meerut	102,906	115,796	113	
Bulandshahr	84,937	75,475	89	
Aligarh	78,395	54,237	69	
Muttra	42,988	56,101	131	
Agra	71,708	68,649	96	
Mainpuri	72,032	56,087	78	
Etah	80,819	68,343	85	
Bareilly	109,787	80,312	73	
Bijnor	82,983	129,244	156	
Budaun	104,666	84,390	81	
Moradabad	137,251	129,939	95	
Shahjahanpur	103,794	93,184	90	
Pilibhit	61,089	86,516	142	
Farrukhabad	88,738	77,024	87	
Etawah	69,559	82,011	118	
Cawnpore	99,051	136,081	137	
Fatehpur	78,476	93,167	119	
Allahabad	159,942	192,271	120	
Jhansi	82,504	190,506	231	
Jalaun	29,508	39,632	134	
Hamirpur	48,800	109,328	224	
Banda	71,398	201,256	282	
Benares	71,105	81,699	115	
Mirzapur	123,186	300,385	244	
Jaunpur	135,465	137,847	102	
Ghazipur	83,847	112,980	135	
Ballia	58 556	101,676	174	
Gorakhpur	308,579	422,693	137	

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* Approximately, because the working life of plough cattle is apparently not uniform. The information collected on this point is not sufficiently definite to be used for actuarial calculations, but it indicates that the good cattle of the upper doab are expected to last distinctly longer than the inferior stock of south Oudh and Benares.

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District.	Number of ploughs.	Number of cows.	Number of cows per 100 ploughs.	Remarks.
1	2	3	4	5
Basti	230,015	285,998	124	
Azamgarh	187,608	199,362	106	
Lucknow	61,271	52,676	86	
Unao	106,408	101,359	95	
Rae Bareli	134,221	138,589	103	
Sitapur	148,399	201,533	136	
Hardoi	142,383	119,055	84	
Kheri	125,450	323,848	258	
Fyzabad	143,359	132,981	93	
Gonda	180,413	313,498	174	
Bahraich	135,237	287,878	213	
Sultanpur	142,019	116,985	82	
Partabgarh	126,555	118,687	94	
Bara Banki	113,216	116,619	103	

3. It will be remembered that this census was taken shortly after a period when losses of stock from famine had been severe: these losses probably affected the number of cows more than that of bullocks, and hence the sources of supply shown in the figures are probably somewhat less than is the case at present; the relative position of different districts is not however likely to be affected materially by this source of error. These figures have been used to check the statements made by the investigating officers, and in nearly every case with satisfactory results. Thus the description given of Ballia as almost self-sufficing is at first sight improbable, but it is fully justified by the position which Ballia occupies in the table.

B.—CONDITIONS OF CATTLE BREEDING.

4. Turning now to the information collected, it is well known that the province, taken as a whole, is not self-sufficing, but imports cattle from elsewhere; and the same is true of many districts of the province considered individually. There

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are however districts, or portions of districts, which produce cattle in excess of local needs and export the surplus: these may be called breeding tracts.

5. In the breeding tracts the production of cattle is carried on in two ways, which may be described as professional breeding and village breeding. In professional breeding we find men owning herds of cows of considerable size, and specialising in the production of agricultural cattle as their sole, or at least their principal, occupation in life. In village breeding we find landholders and cultivators owning cows in varying numbers and selling the young stock that is in excess of their needs. The dividing line cannot of course be drawn with absolute accuracy: in some cases it is difficult to say whether the breeding is best described as "professional," or "village," but in the majority of cases the distinction is plain. The distinction is also important because, as will be seen later on, the needs of the industry may differ substantially in the two classes.

6. The survey shows that professional breeding is practically confined to the following areas:—

I.—Submontane areas.

Bijnor	... tahsil Nagina.
Moradabad	... tahsils Hasanpur and Thakurdwara.
Shahjahanpur	... tahsil Pawayan.
Pilibhit	... ,, Puranpur.
Sitapur	... tahsils Misrik and Biswan.
Hardoi	... tahsil Shahabad.
Kheri	... all tahsils.
Bahraich	... tahsils Nanpara and Kaisarganj.

II.—Areas south of Jumna.

Etawah	... trans-Jumna tracts.
Mirzapur	... Dudhi and Robertsganj.

III.—Other areas.

Muzaffarnagar	... Ganges *khadir*.
Meerut	... Ditto.

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The conditions of breeding in each of these areas are summarised in appendix A.

7. Village breeding is of course found in parts of every district, but its importance as a source of supply of agricultural cattle varies very greatly according to differences in local conditions. The conditions prevailing in each of the plains districts are shown in appendix B.

The distribution of village breeding follows generally that of professional breeding, but its limits are naturally wider; each centre of professional breeding is surrounded by a larger tract in which village breeding is important.

8. It will be seen from the facts detailed in the appendices that as a general rule village breeding and professional breeding are alike in being conditioned by the existence of suitable grazing grounds. The systems differ in two important features. In the first place the professional breeders in almost all cases take special pains to have good bulls in their herds and to keep inferior bulls at a distance: village breeders will usually take some pains to get their cows covered by a good bull if one is available, but as a rule no individual is in a position to maintain a bull for his own cows, and while some villages have made provision by joint action; in the great majority the bulls available are inferior, a fact which means both fewer and inferior young stock. In the second place, the calves in the large herds are very much better nourished as they get most* or all of the milk, while in the villages their share is very much less and is often inadequate. It follows that professional breeding deserves encouragement especially on the ground that it means better working stock.

C.—Grazing grounds for professional breeders.

9. To ensure the maintenance of professional breeding on the existing scale it is primarily a question of preserving

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*The herdsmen are in some cases said to take some of the milk without their masters' knowledge.

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the existing grazing grounds. Most of these may be classed as—

(1) The Nepal tarai.
(2) Government forests.
(3) Private forests.
(4) A few portions of the Ganges lowlands.
(5) The Naini Tal *tarai.*

The possible cultivation of the Nepal *tarai* has been the subject of correspondence,* and the Director of Land Records and Agriculture is charged with the duty of reporting periodically on the question. Should it appear from his next report (due in 1914) that the grazing areas are threatened,† the position will be grave, so grave in my opinion as to justify the assumption of some pecuniary liability on the part of Government. The arrangements to be made would be matter for negotiation: perhaps it might be possible to obtain a lease of the land required (either in the name of Government or of some leading breeders with Government as surety) on terms that would be acceptable to the Darbar, and to charge grazing fees somewhat higher than those now taken. This is a suggestion only of the direction in which action might be attempted should the emergency arise.

10 The government forests are broadly speaking the subject of grumbling among professional breeders. The facts on which this attitude is founded appear to be that whereas in Nepal or in private forests the payment of grazing fees leaves the herds free to go where they like, in government forests they are—in the interests of adjoining tracts where the timber is of value—confined to particular areas and cannot shift pasture with the same freedom. Breeders complain that this restriction is injurious, partly in increasing the risk of contagious disease, and partly in preventing them from

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*Vide G. O. no. 1428/I—495, dated the 22nd July 1909.

†Since this was written I have heard unofficially that large schemes are under consideration which would bring practically the whole of the chief grazing grounds under cultivation.

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regulating the diet of their herds according to their varying needs. They also complain that they cannot burn the coarse grasses as is the practice in Nepal.[*] This is the breeders' point of view. I have thought it right to state it, but the statement must not be taken as endorsing it.

11. The Conservators of forests have courteously furnished me with statements of the forest areas in the plains which are managed primarily for grazing. Without going into the details of these, it may be said that grass burning is practised in the great majority of these areas: that the forests in Gorakhpur, Gonda, Bahraich and Naini Tal have been or are over grazed; and that there is nowhere room for many large additional herds. (This last statement does not apply to the government estates forests which are dealt with further on.) It may presumably be considered as settled that these grazing areas are protected and will not be diverted to other purposes. As regards extensions, the Conservators are unable to point to any areas which in their opinion could be added to the list without serious detriment to existing tree forests: but the Conservator of the eastern circle informs me that the future of the cis-Sarda forests in Kheri is shortly to be decided. In this case I trust that the claims of the cattle will receive full consideration: the stock of the district are among the best in the provinces, and there are undoubtedly complaints of insufficient grazing which limits the size and number of the herds: I would therefore urge that as much as possible of these forests should be set aside for development as grazing land.

12. Similar questions will presumably arise from time to time regarding the future of other areas of forest lands in the plains, and I would suggest that when they arise the department of agriculture should be consulted regarding the need of grazing land in the localities concerned. I make this

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[*] At least one breeder pressed the point that the burning of grass would erally benefit the forests by keeping down the insect pests that are so injurious to the growth of timber!

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suggestion because I hold that such questions should be considered for the province as a whole and not merely from the standpoint of the particular district. I have noticed in forest literature from time to time a view that may be stated baldly as follows: All cattle are nuisances: the forest has to endure the nuisance caused by the cattle of the neighbourhood, but it should at least be freed from the nuisance of cattle coming from a distance. The sounder view appears to me to be that Government is interested in the supply of cattle for the whole provinces, and that as the forest lands can supply large numbers of stock superior in quality to what can be raised elsewhere, they should be so managed as to give the largest possible number of such stock without regard to the locality from which the herds are brought. I am not of course suggesting that established tree forest should be sacrificed: my point is that when the future of forest land comes under consideration, adequate attention should be paid to the demand for grazing land.

13. The maintenance of the private forests and pastures is indispensable to the continuance of professional breeding. So far as is known at present, these are not threatened in Mirzapur, but they are in danger throughout the whole submontane tract. The question of the steps to be taken for their preservation has been referred to the Board of Revenue, and need not be discussed here. It is worth noting that in some localities there is a tendency for grazing fees to rise. It has not progressed so far as to safeguard the pastures from being broken up, but it is in existence, and may be expected to operate with gradually increasing force, so that it may well be the case that only temporary measures are called for from Government.

14. The amount of professional breeding in the lowlands is small, and the question of grazing land there can be considered more appropriately under village breeding.

15. Lastly as regards the Tarai Government estates, the Deputy Commissioner writes "The forest and waste land of the *tarai* is not fully occupied by grazing cattle and there is room for a substantial addition to the numbers grazing between November and June. This is specially true of the eastern tarai." The estates forest officer also shows a large capacity in excess of the number of stock, and though the Conservator is inclined to think that the capacity is over estimated, there is no doubt that in this case there is room for extension.

D.—POSSIBLE EXTENSION OF PROFESSIONAL BREEDING.

16. It has been already indicated that the existing extensive breeding grounds apart from the tarai are as a rule fully stocked, and any minor additions to them would be quickly occupied by the expansion of existing herds. In case however new extensive areas can be made available the question will arise what steps can be taken to accelerate the formation of new herds. So far as the tarai is concerned, such herds would be expected to come mainly from the Bareilly district, and the Commissioner of Rohilkhand has been consulted as to the possibility of extension. His reply will, if necessary, be made the subject of a separate reference. Should new areas become extensive elsewhere, the question will have to be dealt with in the light of local conditions: but it is possible that arrangements may be required for the supply of capital to enable breeders to make a start. The question of capital will be dealt with in a subsequent section.

E.—SUPPLY OF BULLS FOR PROFESSIONAL BREEDING.

17. The only considerable area where the herd bulls are defective is south Mirzapur, and the Collector considers that much good could be done by distributing bulls among these herds. The most suitable type of bull would have to be ascertained as the cows are of distinct type; and as the progeny of this tract is useless to the province and is bred for

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export, improvement of the supply is a matter of local, rather than provincial, importance, and action may properly be left to the management of the Dudhi estate.

F.—MAINTENANCE OF VILLAGE BREEDING.

18. The maintenance of village breeding in the areas where cows are concentrated (described in appendix B) is primarily a question of preserving the grazing grounds, and as has been said above this question is before the Board of Revenue. A list of the localities where the larger grazing grounds are found is given in appendix C, as a guide to district officers in carrying out any instructions that may be issued on this subject; it is not of course exhaustive, but it indicates the localities where action is of special importance. I have thought it unnecessary to compile lists for the Jhansi division, where there appears to be no present danger.

19. Apart from grazing land, the future of village breeding depends very largely on the supply of bulls. There are cases where the people would keep more cows if they had access to decent bulls, and in any case good bulls mean more, and better, stock from the existing cows. The practice of providing sacred bulls gives little help either in Bundelkhand or in the submontane tract from Kheri westwards, and some secular organisation is required. The localities where the concentration of cows makes action desirable in the first instance are indicated in appendix D.

20. In the first place it is necessary to consider the type of bulls that should be supplied. Mixed as the cattle of the provinces are, their investigation has gone sufficiently far to justify the statement that they are a mixture of three "nations," western, northern and southern, and this fact makes it possible for the first time to lay down the outlines of a definite policy. The term "nation" is used in order to avoid possible misuse of words such as "breed" which have a

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definite technical meaning: our knowledge is as yet not sufficiently detailed to speak of breeds except in a few cases.

21. Cows of the western "nation" are found in fair numbers in the Meerut and Agra divisions (uplands and Jumna *khadir*, but *not* the Ganges *khadir*), and as far east as Etawah. Outside this area, bulls of the western "nation" (particularly the type of the districts adjoining the upper doab on the west) are wanted, in earnest, by a few of the wealthier men who keep western cows for milk, but they will not do much for the supply of agricultural cattle, and in my opinion if they are provided by local funds, they should be as nearly self supporting as possible: in fact I would make this a test of the reality of the demand. Western bulls are wanted then for the benefit of the cattle supply only in the upper doab and as far east as Etawah, and there only to a limited extent.

22. The southern "nation" is found in Bundelkhand and Mirzapur, and it is improbable in the light of present knowledge that bulls of either the northern or western "nations" would be useful there. The supply in this tract should be drawn from the best indigenous strains, or from the states lying to the south. Our knowledge of this "nation" is not yet sufficiently detailed to give more precise indications of the type.

23. The northern "nation" prevails throughout the whole submontane breeding tract from the Ganges lowlands in Muzaffarnagar on the west to Bahraich and Gonda on the east. It reaches its best in the Kherigarh, Parehar and Ponwar breeds, but throughout the tract the cows show a tendency to uniformity and owners are practically unanimous in asking for bulls of one of these well-known breeds. These cows then should be supplied chiefly with bulls from Pilibhit and Kheri.

24. It is possible there may be a fourth, or eastern "nation" in Gorakhpur, Ballia and adjoining districts, but at present there is no demand for bulls in these areas and the point need not be considered further.

25. The organisation for supplying bulls must be adapted to the local conditions, but the following types are suggested.

26. Where the cows to be considered are few and scattered, it is necessary to have the bulls located at convenient centres to which the cows can be brought. The system is not ideal, but it can be worked in the case of western bulls provided the animal is not kept tied in a stall: a half-acre paddock with the stall at one side should be provided as a minimum, and the bull should have as much liberty as possible. This system is applicable where western bulls are provided for the convenience of well-to-do cow owners, and also in my opinion in any parts of the Meerut and Agra divisions where it may be decided to locate these bulls. The western cows are to be found as individuals and not in herds.

27. In my opinion no provincial charge should be incurred in the case of western bulls. Assistance may be given as is now done in obtaining animals from Hissar, but the cost should be borne locally. It is within the powers of district boards to spend money in this direction, but in doing so they should recognise clearly that (except in parts of the Meerut division) they are spending money for the well-to-do and not for the poor: and any system of subscriptions or covering fees that may be found feasible should be introduced to recoup a portion at least of the expenditure. The ideal system is that these western bulls should be provided either by large landholders for their tenants, or by agricultural associations or co-operative organisations for the benefit of their members.

28. In the submontane breeding tracts the system of keeping bulls at stands is not to be recommended: they should run with the village herds, and it follows almost necessarily

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that they should be the property of the cow owners, since there must be a certain amount of supervision in the case of animals owned by Government or by the district board, and supervision on the scale required would be a very heavy burthen. The ideal is that in each village or group of villages cow owners should unite to provide the number of bulls they need, and this ideal is realised in a sufficient number of villages to show that it is not impossible. They may either set aside promising calves by arrangement with the owner, or purchase bulls from any source (such as the Kheri government bull dépôt, which will probably in time need branch establishments throughout the tract).

The co-operative system appears to be specially suitable to such cases, and I have brought the matter to the Registrar's notice: but the same object could also be secured by the offer of *takavi* advances to groups of cow owners to enable them to buy a bull, the period for repayment being fixed with due regard to the conditions.

29. To introduce any arrangement of this kind would involve at the outset close co-operation between the district officer and the Superintendent of the civil veterinary department. It would be the former's business to find the village or villages prepared to have a bull on the easy payment system that has been indicated: and it would be the latter's duty to send a good bull and leave it with the villagers on their executing the usual joint bond for repayment.* But if the bulls first supplied proved to be successful, it is probable that a regular demand would arise which would keep the dépôt going as a self-supporting business.

30. There are of course cases where it may be doubtful at the outset if bulls from the dépôt would be worth their cost to the people: in such cases Government might legitimately

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* There would be no necessity for cash to be paid: the amount of the loan sanctioned would be credited at once to the dépôt account.

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set one bull free in a tract where cows are numbered by the hundred, making it plain that any more would have to be paid for: but in ordinary cases the most important points are (*a*) to have bulls fit for the cows, and (*b*) to offer these to the people on terms that are within their means, the actual price being probably a point of less importance than the terms as regards repayments.

31. The case of Bundelkhand is probably more difficult than that of the submontane areas. Owners of cows appear to think much less of the offspring and much more of the milk; and it is doubtful whether they will pay for a better bull, while if they decide to do so a separate rearing dépôt will be found necessary in order to meet the demand. The endeavours made some years ago to place out bulls with men of position in this region must be condemned as failures: those who took bulls very soon tired of them, and it is fairly certain that if better bulls are to be introduced they must belong to the cow owners. Only detailed enquiries by district officers can show whether the owners are prepared to bear the cost, and the lines on which operations can be conducted.

32. Lastly it is necessary to consider the question of bulls for the localities where the ordinary cows are not concentrated. No serious complaints of the numbers or quality are made in the Benares, Gorakhpur or Fyzabad divisions or the districts of Muttra,* Fatehpur, Allahabad, Rae Bareli and Sitapur, that is to say on the eastern side of the province: while complaints are general on the west. Here it is difficult to suggest any practical improvement: the cows are not concentrated in herds, the owners of which can reasonably be expected to provide a bull, and the cost of maintaining bulls at stands would be relatively great and the benefits somewhat problematical. I do not find myself in a position to put forward any proposals regarding these tracts.

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* Muttra is a special case, due apparently to the religious position of the district.

CSL

G.—POSSIBLE EXTENSION OF VILLAGE BREEDING.

33. In all the tracts that have so far been discussed the number of cows is determined mainly by the area of pasture, and it would seem that extension of pastures is the first condition for increasing the number of cows. But it is impossible to overlook the case of the Ballia district, where a relatively large stock of cows is kept without any exceptional resources for feeding them: and the same phenomenon appears in numerous villages scattered through other districts which as a whole are not breeding areas. In fact the rearing of young stock in the villages appears to be to a considerable extent a matter of taste and habit, and the question must be considered whether it is possible to take any action towards extending the custom. There seems to be little doubt that the influence of the Dadri fair is an important factor in the maintenance of the stock of cows in Ballia, and also in the treatment of the young stock, and it may be inferred that the union of a festival and a good market is the favourable influence. On the other hand, the experience gained in recent years indicates that an annual cattle show, even with substantial prizes, is not likely to do much practical good where the elements of festival and a large market are absent.

34. It must be admitted too that the cattle shows held at the fairs in the Meerut division have done little or nothing to promote the production of cattle: this fact is the more striking as the same fairs have undoubtedly done much to promote horse breeding, and many of the cultivators have as much taste for cattle as for horses. It is not easy to state all the reasons for this contrast, but one of them is the unsuitability of the prize lists for cattle. At the horse shows the prizes are offered as is right for mares and young stock, while at the cattle shows they are offered mainly for working cattle, which are nearly always imported. The suggestion is put forward that an attempt should be made to develop more

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effective cattle shows at Muzaffarnagar, Nauchandi, Bulandshahr and Aligarh by augmenting the prize money, revising the schedules, and allotting the money in prizes for cows with calf and for young stock, on the same lines as the horse shows, with special attention to the breed. If the cultivators will get into the habit of showing their best young stock, competition will soon lead to an improvement in quality, and the shows will become recognised as places where high-class young stock of the western breed can be purchased. (At the start some inducement might have to be offered to dealers who visit the Punjab to attend the shows.)

35. A similar policy might be tried in connection with other fairs and exhibitions, but cattle shows pure and simple cannot be recommended at present. The most suitable classes for a show would be somewhat as follows, the breed or type for which they are offered being settled for each show in consultation with the Superintendent of the civil veterinary department:—

(*a*) Bulls for breeding.

(*b*) Cows with calf.

(*c*) Bull calves with milk teeth.

(*d*) Bull calves with two teeth.

(*e*) Heifers with milk teeth.

(*f*) Heifers with two teeth.

A scale on these lines might be drawn out as a standard in substitution for that contained in paragraph 2220 of the Manual of Government Orders.

36. Apart from assistance to cattle shows in connection with fairs and exhibitions, it does not appear that Government can take direct action for the extension of village breeding in closely cultivated areas: but the object is one which should be kept prominently before any agricultural associations that may be formed, and if an association decides to establish

a show, it may fairly receive a grant towards its prize fund, provided the schedule of prizes and the arrangements for awarding them are considered to be satisfactory. The matter is also worthy of the attention of co-operative societies: there are probably cases where a society could arrange for an addition to the cows owned by its members, for a gradual improvement in their quality, and for the use of a suitable bull. No large or sudden movement can be looked for in this direction, if only for the reason that large numbers of cows cannot be bought at once; but persistent effort might be expected to lead to a gradual increase in the wealth of the members.

H.—IMPORT AND EXPORT OF CATTLE.

37. The railways are not used to a large extent for transport of cattle. The figures of the last two years are as follows:—

	Number of horned animals.	
	Imported.	Exported.
1909-10	11,788	13,661
1910-11	4,550	14,548

The imports come almost entirely from the Punjab, while the exports are directed mainly to Calcutta and Bombay. One aspect of this trade will be dealt with below, but it is obvious that the net loss by export by rail is negligible.

38. There is of course a considerable volume of local trade across the frontiers of the provinces: no estimate can be made of the number of animals involved as many of them do not use the roads, but are marched across country, but there is no reason to think that this local trade results in a net efflux of cattle: such indications as exist suggest that the stock of cattle in the province is increased on balance by its means.

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39. The following lines of export have been noticed in the course of the survey :—

(*a*) Mirzapur to Chhota Nagpur.
(*b*) Muttra to Calcutta.
(*c*) Allahabad to Calcutta.
(*d*) Mirzapur to Calcutta.
(*e*) Ballia to Calcutta.

The first case is special. The cattle bred in the hilly tracts of Mirzapur have been shown by experience to be unfit for working in the plains, and they are sent regularly to some districts of Chhota Nagpur, where a demand for them exists.

40. The remaining cases are, it will be seen, of exports to Calcutta. Cows in (relatively) considerable numbers are bought at the Kosi market in Muttra and sent to Calcutta, being put on the rail after marching distances which vary according to the supplies of fodder available. Thus the trade cannot be identified in the returns for the different traffic blocks as it is put on the railway anywhere between Kosi and Moghal Sarai. It is commonly stated in the market that the cows sent to Calcutta are milked until dry and then slaughtered.

The cows do not as a rule come from the Muttra district but from neighbouring Native States.

41. As regards Allahabad, the Karma market in tahsil Karchhana is visited by butchers from Calcutta, but the trade is not very extensive. Cattle are sent from Mirzapur to the Calcutta slaughter houses, but the Collector is confident that this does not represent any serious loss : the animals sent are either bullocks past their work or cows that have proved to be barren. Finally a certain number of cows are purchased by Calcutta butchers at the Dadri fair in Ballia, being (it is said) destined for the slaughter house as soon as they go out of milk.

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42. It may fairly be said that the loss of cows to Calcutta is regrettable in the present state of the cattle supply. No suggestion can be made for interference with the food supply of the capital city of another province, but it would probably benefit the United Provinces on the whole if the dairying business in Calcutta could be so organised that milch cows should have a longer life. Apart from this drain, the extent of which is probably much over-rated in the mind of the public, the supply of cattle cannot be said to be affected by the existence of an export trade.

43. The number of cattle brought into the province annually is very great, and the organisation of the trade is complex. In some cases dealers from outside the province bring down their stock to one of the large fairs, and then distribute the unsold animals through the smaller markets or in retail sales along the road; in others dealers from these provinces go to adjoining provinces or states to collect stock for disposal in the localities where they have a connection. Others again are local dealers, getting foreign stock at the large fairs and dealing in both imported and home bred animals. Lists of the chief groups of dealers operating in each district with notes on their methods of business are on record in the Director's office: it has not been thought worth while to append them to this note.

44. Taking a general view, the sources of import are:—

(1) The Punjab and its States, Rajputana, and west Central India. This area probably supplies the bulk of the upper doab, while its stock, in gradually diminishing numbers, penetrates the province as far as its eastern borders.

(2) The Central Indian States adjoining the districts of the Jhansi division, which supply portions of that division and of the country to the north.

(3) North Bihar, which contributes to the supply in the eastern districts largely through the Dadri fair.

45. The bulk of the dealers appears to be fairly satisfied with the conditions of their business, but the following complaints came to light during the survey:

(*a*) Dealers of the butcher caste, who are the chief importers in the west of the province, complain that their caste is not allowed to buy cattle in certain States of Rajputana. The motive underlying this restriction is apparent, and probably representations on the subject are undesirable at present.

(*b*) The heavy export duties imposed on cattle leaving the Gwalior State are greatly complained of by dealers, specially by those who have been accustomed to collect young stock for the Batesar fair from breeders in that State. The duty on animals worth Rs. 50 and under was raised in 1910 to Rs. 3 per head, and in consequence a relatively small number of Gwalior cattle appeared at Batesar. In 1911 this rate was continued and imports to the fair were again reduced. The matter is of course political, and I make no recommendations.

(*c*) The dealers who bring cattle from the west complain loudly of the difficulty of feeding their stock along the main routes, particularly the road from Kosi viâ Fatehabad to Batesar and on to Etawah: the trade would be facilitated if it should be found possible to arrange for the reservation of grazing areas of moderate size at the regular halting places along this route, which is, so far as I know, the most frequented of all.

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(*d*) A more general complaint is the want of capital. Prices in the breeding areas have risen so greatly that a much larger amount of capital is now required to move the same number of stock. The butcher fraternity as a whole appear to be comparatively well off in this respect as the richer men finance their caste fellows on relatively easy terms; but the *banjaras*, who conduct collectively a very large trade, are for the most part dependent on money lenders and have to pay interest at rates that limit their business. The lowest rate noticed is 24 per cent. while 36 and even 48 per cent. are sometimes paid. Complaints on this score were most numerous in Muttra, Agra and Pilibhit.

I. Distributive organisation.

46. The trade in cattle is fully organised through the fairs, markets and travelling dealers; it need not be described in detail as the examination made shows that assistance from Government is not required; but a few points of interest may be noted here.

47. The principal fairs are those of Batesar, Kakora, Makanpur and Dadri. Batesar is one of the main sources from which the province obtains superior cattle. The bulk of the stock from the Punjab is sold to the Meerut division, while the rest is distributed gradually eastwards. The Gwalior cattle on the other hand pass principally into the Agra, Allahabad and Rohilkhand divisions.

Kakora fair serves mainly to distribute the cattle bred along the Ganges, but a fair proportion of superior young stock brought from a distance also changes hands during the fair.

Makanpur draws its supplies about equally from (*a*) the adjoining districts, and (*b*) the Punjab, Rajputana and Central India; and its stock is distributed throughout south Oudh as well as in the Allahabad division.

CSL

Dadri supplies chiefly the Benares division and Azamgarh with stock bred locally or in Bihar.

48. Markets are numerous in most districts: they usually have a small proportion of cattle from outside the district, the bulk of the sales representing either young local stock or mature animals that the owner has decided—or been compelled—to part with. It is largely through the local markets that worn-out cattle now find their way into the butchers' hands, no longer remaining to cumber the village pastures.

49. The practice of different localities in regard to their stock naturally affects the class of animals in the markets. Thus the upper doab usually buys matured bullocks that can go into hard work at once: in parts of Agra and Rohilkhand, on the other hand, cultivators like to buy young stock from the Punjab, give them light work till fully mature and then sell them to the upper doab at enhanced prices. Again in most parts of the country the cultivator both buys and sells just before the rains: but in some places, especially where cattle are not used in irrigation, it is a common practice to sell as soon as the crops are sown in October and to buy in the following June, and in such localities, prices in October and November favour buyers rather than sellers.

50. There are a few markets of more than local importance. Kosi in the Muttra district is an instance: it is regularly attended by sellers from the Punjab and by buyers from various parts of the provinces, and even from Calcutta, and its reputation is such that "Kosi" is a popular name for cattle of the western "nation." Various markets in Bundelkhand too are attended by purchasers from south Oudh and Benares, and the markets in this tract are much more important as distributaries than in the breeding tracts in the north of the province where dealers usually buy on the spot.

51. The organisation of itinerant dealers is remarkably widespread, and serves its purpose excellently, but a description of it is unnecessary.

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J.—SUPPLY OF CAPITAL.

52. The question of supplying capital has already been referred to incidentally. It appears to be probable that advances may be required in some localities from time to time, for some or other of the following purposes:—

(*a*) Establishment of new herds.

(*b*) Replenishment or extension of existing herds.

(*c*) Supply of herd bulls in villages.

(*d*) Supply of cows in villages.

(*e*) Assistance to dealers.

(*a*) The question of establishing new herds will arise only if new extensive grazing grounds can be made available. If this is done it may be found desirable to assist breeders to start with the nucleus of really good herds by lending them the capital they require. In such cases the terms of repayment would necessarily require careful adjustment.

(*b*) From time to time it happens that particular herds, or the herds of a particular area, are diminished by epidemic disease, drought or some other calamity. In such cases it takes time for the herds to grow to their size by natural increase, and bearing in mind that professional breeding gives the best chance of maintaining the quality of the stock, it may be desirable to lend money to breeders to enable them to purchase cows. In this case too repayment should be spread over a considerable period. An instance of the position indicated may be found in the trans-Jumna tract in Etawah, where in 1910 the herds were found to be still depleted as the result of the droughts of 1906—1908. The Collector however informs me that owners in this tract are unwilling to take advances, so that here the practical question does not arise.

(*c*) The supply of herd bulls in villages has been dealt with in a previous section.

(*d*) As regards the supply of cows in villages, the law and rules for advances under Act I of 1884 appear to permit advances for the purchase of cows, but this is not perhaps generally understood and I understand that such advances are not in fact applied for. There can be no question that it is desirable that every cultivator who can feed a cow should be able to command the capital to buy one, and possibly it might be made clear to the public that capital for this purpose is on offer.

(*e*) Lastly, as regards dealers, I think it is desirable that district officers in the Meerut, Agra and Rohilkhand divisions should be authorised to grant loans to *banjara* dealers who wish to bring agricultural cattle into the provinces. Such loans would be adjustable within the year, or even a shorter period.

53. The terms of Act I of 1884 appear to be sufficiently wide to authorise loans of the kinds indicated in all cases where the applicants are owners or occupies of arable land. This would I think cover all cases under heads (*c*) and (*d*), and some cases under (*a*) and (*b*), but comparatively few cases under (*e*). If Government decides that the offer of advances is desirable, it would be sufficient to extend the advantages of the Act to " breeders of and dealers in cattle for agricultural purposes ." The alternative method of supplying capital, co-operative organisation, is, as has been indicated, applicable in case (*c*), and I understand that credit socieites are ready to give loans in case (*d*): but the other three cases are probably too individualistic to be dealt with in the same way.

W. H. MORELAND,

Director of Land Records and Agriculture,

United Provinces, on special duty.

31*st May* 1912.

CSL

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APPENDIX A.—PROFESSIONAL BREEDING TRACTS.

BIJNOR.

Nagina.—Professional breeders are found in the two northern parganas, Afzalgarh and Barhapura, which contain a strip of forest under the hills.

Grazing fees in the forests are charged—at various rates —to all cow owners who are not actually cultivators in the village.

Breeders are very particular about bulls, and keep their cows separate from other herds; they are satisfied with the bulls which they rear for themselves, and are not anxious to have imported bulls. There are five groups of breeders, who own about 2,000 cows: the chief group is known as Nawabpura. The cows are all of the local breed, but those of Nawabpura are considered superior to the others.

The Nawabpura herd stays in the forest all the year round, shelters being erected at convenient places with separate pens for the young stock: the cows are driven out daily to graze, but cows about to calve and young calves are detained in the shelter.

About one-third of the cows produce calves yearly. The stock is sold mainly to the *banjaras* of Rohilkhand and the *tarai*.

The cattle of this herd are fast trotters, and are often put to work for a time in light carts before being yoked to the plough: a good pair (with four teeth) will bring Rs. 100 or more.

The remaining herds are usually brought back to the villages during the rains owing to risk of loss from wild animals, and they are apparently not so well cared for in the forest, but the general practice is similar to that of Nawabpura.

CSL

Grazing fees.—The Nawabpura breeders have a lease of the land on which their herds graze, and so there are no grazing fees: elsewhere the fees are as follows:—

Mahmudpur.—Four annas and six pies per head per season.

Kawakher.—Twelve rupees per 100 for the season = two annas per head.

(This has recently been raised from Rs. 10.)

Champatpur and Rao.—Four annas and six pies per head per season and eight annas and six pies when a calf is sold.

MORADABAD.

Thakurdwara.—There are four considerable herds, aggregating 800 to 900 cows. They are of the local breed, and promising young males of the herd are kept for bulls.

They graze in private forests near Kashipur and Ramnagar in the Naini Tal district, the system being generally similar to that followed in Bijnor.

The stock is sold largely to dealers from the east, the average price (with four teeth) being about Rs. 25; castration follows the sale.

About one-third of the cows produce calves yearly, but losses in the forest are numerous.

Grazing fees.—In Ramnagar are eight annas per head per season. The forest in Kashipur belongs to the breeder.

Hasanpur.—Three herds exist, aggregating about 300 cows.

They are of local breed, and are served by bulls kept in the herd. They graze mostly in the Ganges *khadir*. The stock is much inferior to that of Thakurdwara and sell for about Rs. 15 a head (with four teeth). Sales are made mostly to *banjaras*.

Grazing fees are nominal or do not exist.

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SHAHJAHANPUR.

Powayan.—Fourteen herds are in existence, aggregating close on 4,000 cows. The cows are of a definite local strain known as *ganjrahi:* much attention is paid to the maintenance of good bulls, which are usually of the same strain, but in some cases a cross with the Parehar breed is preferred.

Ganjrahi cattle are described by the Superintendent of the civil veterinary department as "desi" with an admixture of Parehar or Ponwar blood, and generally speaking of much better quality than the "desi" strain.

About one-third of the cows calve yearly, but extensive losses of young stock result from wild animals.

The cattle are superior, and at one year of age fetch Rs. 30 to 35 per head, running up to as much as Rs. 50 for exceptional animals. They are used in light carts as well as in ploughs. The stock is sold to the local *banjaras*, and also to dealers from the eastern districts.

Grazing is managed as follows :—

Khutar group.—November to February in Nepal, and Pilibhit forests during the rains.

Nawadia.—Puranpur forests from November to June. Local jungles during the rains.

Seramau.—Kheri forests from November to June. The remainder graze in the local forests.

Grazing fees, Nepal.—Four annas per head per season for regular graziers: the charge is 6 annas for occasional visitors. *Kheri.*—Four annas per head per season. *Pilibhit.*—Four annas per head per season for good grazing: lower rates are charged for inferior areas. *Local forests.*—Usually free.

Nepal grazing is preferred by those who can take the risk of the long journey.

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PILIBHIT.

Puranpur.

The number of professional breeders in Puranpur is larger than in any of the localities hitherto referred to. They are reticent as to the extent of their herds, owing to the fear of enhanced assessments of income tax, but the aggregate of the herds is apparently close on 10,000 cows. The great majority are of the distinct Ponwar breed, but some herds consist of a cross between Ponwar and Parehar. All breeders are careful in their choice of bulls.

About one-third of the cows calve yearly, but losses in rearing are heavy, and the stock for sale in a year is put at about one-fifth of the number of cows. The stock is superior, the average price for three year olds being about Rs. 45.

Most of the herds graze in Nepal from October to June, and in local forests during the rains: the rest graze in local forests throughout the year. Nepal is preferred, partly on account of the superiority of the grass and the assured water-supply, partly because the local private forests are close to the government forests, and hence the freedom of the herds is restricted.

Grazing fees in Nepal are about 4 annas per head per season, in the local forests two annas to three annas.

Most of the stock is sold to dealers from Oudh and the eastern districts.

Arrangements are common by which cows belonging to village breeders are joined to the professional breeder's herds, and get the services of their bulls.

SITAPUR.

Professional breeders are found in portions of Misrikh and Biswan tahsils. The herds aggregate about 700 cows in the former and 500 in the latter: in addition herds aggregating nearly 1,000 are owned by taluqdars who are said not to sell the young stock but to supply their cultivators.

The bulls are usually of one of the pure Kheri breeds, and the cows are of the mixed class described as *ganjrahi*.

One herd grazes in Nepal, the others in Pilibhit and Kheri private forests; but during the rains they are grazed, if possible, along the Kathna river.

The young stock are sold mainly in the local markets.

HARDOI.

There are two professional breeders in Shahabad tahsil, with herds of about 300 cows and their own bulls. The herds are kept in Kheri forests except during the rains: the stock is usually sold very young, and is of superior quality, being used largely for carting.

KHERI.

Professional breeders are found in all three tahsils, but are most numerous in Nighasan. The large herds examined aggregate over six thousand cows, but there are numerous smaller herds, and the total number of cows owned by professional breeders is probably much greater than this.

Some of the herds consist of carefully maintained strains of the Kherigarh and Parehar types: others are less pure but approximate to the same types. Much care is taken by the leading men in the choice of bulls; but the smaller herds would probably be greatly benefited by the supply of better animals than they can command.

The proportion of young stock matured is very low, not more than 15 to 20 per cent. of the cows. The bulk are sold to the dealers from the east.

The larger herds graze in Nepal from November till June, and along the Kathna, the Gumti, or the Sarda during the rains: the smaller herds graze in the private and government forests of the district, but there is not room for all, and according to the breeders the land is over-grazed: it is said that this results in an unusual amount of sickness, accounting for a portion of the very heavy losses of young

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stock. Private forests are preferred because of the difficulties in changing pasture in government forests.

Grazing fees in Nepal are about four annas per head per season: in local private forests two annas; and in government forests two annas for neighbours, and four annas for residents at a distance.

BAHRAICH.

The district is distinguished by the large number of moderate sized herds of cows, kept mainly in Nanpara and to a less extent in Kaisarganj tahsil, the numbers in the herds enumerated approximating to 5,000. The cows are generally of the Kheri type but much inferior in quality. The Nanpara strain is distinguished from the Risia strain found in the same tahsil, both being cheap and well suited for agricultural work.

The local supply of bulls is considered by the breeders to be satisfactory in numbers and quality. The young stock are taken by *banjaras* mainly to Oudh and the eastern districts.

Many of the breeders are *ahirs* and deal in *ghi* as well as in young stock. The calves therefore do not, as in the districts previously enumerated, get all the milk of their dams, but only one half; but the yield of milk is reported to give a surplus after providing sufficient nourishment.

Local grazing is fairly plentiful, while a considerable portion of the government forests consists of open grass lands with scanty and inferior trees, and this is used for grazing from November to June.

ETAWAH.

Professional breeders are found in the villages south of the Jumna, but their herds are reported to have been very seriously depleted by the droughts of 1905—1907, and only ten herds, varying from 20 to 40 animals, were found in existence.

The cows are of the local breed, and the bulls usually of the same, though a "western" bull is occasionally found.

CSL

There are no complaints of the numbers or quality of the bulls. The calves get all the milk of their dams.

Nothing is paid for grazing on the ravines or waste land. In the Fisher forests near Etawah the fee is Re. 1 per season, but this is practically monopolized by the cattle of the city.

The stock is sold in local markets and also to *banjaras.*

MIRZAPUR.

Professional breeding is carried on on a considerable scale in the south of the district, where herds exceeding in the aggregate 4,000 cows have been enumerated.

The cows are of the local breed and distinguished by their low stature: the supply of bulls is not satisfactory, and the Collector thinks that much practical good could be done by free distribution of better bulls. The young stock cannot work in the Gangetic plain, but are exported for agricultural work to Chhota Nagpur.

The herds graze in the local forests from July to December: food and water then become scarce and they are marched to Native States lying to the south. The usual grazing fee is Rs. 4 per 100 head.

MUZAFFARNAGAR.

A few professional breeders are found in the Ganges *khadir*, in tahsils Muzaffarnagar and Jansath; the large herds aggregate about 1,000 cows of the local breed but of superior quality.

Bulls of the same type are kept by the breeders, young animals being carefully chosen for the purpose.

The cattle are grazed—without fee—in the *khadir*. The cows are not milked. Young stock are sold to local cultivators and to *banjaras.*

The stock is superior to ordinary local animals but is inferior to that seen in Bijnor: the reason assigned is the poor quality of the *khadir* grass.

The Jamna *khadir*, where there is room for professional breeding, is devoted mainly to buffaloes kept for *ghi*. The cows found there are of superior quality, showing traces of the "western" strain, but their number is small.

MEERUT.

Conditions in the Ganges *khadir* are similar to those of Muzaffarnagar, the breeders being mainly located in pargana Hastinapur.

GENERAL.

The following list of owners of herds cannot be considered exhaustive, but it is sufficiently comprehensive to enable officers to get into touch with representative professional breeders in these tracts :—

District.	Tahsil.	Village.	Name.
Bijnor ...	Nagina ...	Rasulpur Muljhain.	Abdullah, son of Sheikh Natthu.
			Ahmad Baksh, son of Ellahi Baksh.
			Kallu, son of Abdul Nabi.
		Dhampur ...	Rani Phul Kunwar of Dhampur.
		Tajpur ...	Raja F. X. Sham Rikh of Tajpur.
		Kawakher ...	Hira Singh and Bhure Singh, sons of Bhupal Singh.
		Benipur ...	Kana Padhan.
			Misri, Jat, son of Umra.
		Sarkara ...	Tulshi, son of Bhagu.
		Jamalpur ...	Anup, son of Bahel.
		Bhagwaha ...	Amra, son of Moti.
			Jhanga, son of Khyali.
			Bhup, son of Kesri.
Moradabad ...	Thakurdwara	Faridnagar ..	Thakur Ishri Singh.
		Pasiapura ...	Jhandu, Ahir.
		Bankawala ...	Abdul Saqi, son of Abdul Wahid.
		Sahispuri ...	Rai Singh, son of Kehar Singh.
	Hasanpur ...	Mahamudabad	Shahzad, son of Sattar.
		Kudeni ...	Lalla, son of Jola Khagi.
		Tigri ...	Ram Lal, son of Harnam Singh.

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District.	Tahsil.	Village.	Name.
Shahjahanpur	Powayan	Khutar	Raja Fateh Sah.
		Bela	Kunwar Khanan Sah.
		Kishanpur	Mola Murao.
		Nawadia Niwazpur.	Ibad Ullah.
			Khushal Gadi.
			Ori, Ahir.
			Gumani, Gadi.
			Gulab, Gadi.
		Kharidpur	Nokhe, Gadi.
		Seramau Shamali.	Kunwar Balwant Singh.
		Mandanpur	Sheo Singh.
		Gulariya	Tilok Singh.
			Lachman Singh
Pilibhit	Puranpur	Madho Tanda	Rai Darshan Singh.
			K. Munna Singh.
			K. Dhun Singh.
			Bikhari, Ahir, son of Daya Ram.
			Medai Singh, son of Dore Singh.
			K. Mehrban Singh.
		Amraya	Amar Singh, Banjara.
		Takiya	Durga, son of Ghareo.
		Kalinagar	Ghamu, son of Haibat.
		Shibnagar	Jodha, son of Chab Nath.
		Gungchai	Pokhar Singh, son of Parbat Singh.
			Jang Bhahadur, son of Puran Singh.
			Umrao Singh, son of Bachhan Singh.
		Dhakachat	Abdus Subhan, son of Pahari.
			Suba, son of Munna.
		Jatpura	Sarabjit Singh.
			Sardar Singh.
			Debi Singh.
			Lakhan Singh.

Other herds exist in the villages of Kalinagar, Daga, Pandarya, Sabalpur, Nahrosa and Hazara.

District.	Tahsil.	Village.	Name.
Sitapur	Misrikh	Dakhyakalan,	Rikha, son of Basawan, Gadi.
		Jalalnagar	Ali Sher Khan, son of Farkhand Khan.
			Baiju, son of Talib, Banjara.

District.	Tahsil.	Village.	Name.
Sitapur—*concluded.*	Misrikh—*concluded.*	Bakhuraha ...	Kalka and Daulat Rai, sons of Kesri Lal.
	Biswan ...	Chinsua Bilsua.	Ram Sewak, Brahman.
		Moharsa ...	Lallu Khan.
		Mahwa Tal ...	Bhawani, Ahir.
		Parsiya ...	Tackan, Ahir.

Large herds of cows are also kept by some of the talukdars of the district.

District.	Tahsil.	Village.	Name.
Hardoi ...	Sahabad ...	Hindunagar,	Chotah, Ahir.
		Abdullanagar,	Dhani, Ahir.
Kheri ...	Nighasan ...	Dharmapur...	Didara, Banjara.
		Lodhpurwa ...	Sambar, Ram Nath and Mahabali.
		Bhawanpur ...	Sheo Prasad.
		Bhainsori ...	Surji Mahanand and Mohan.
		Tirkaulia ...	Ajodhia, Jokhe and Baij Nath.
		Pallia ...	Badal Khan, Gulam Husain and Chunu.
		Baragaon ...	Juna, son of Husaini.
	Muhamdi ...	Rajwapur ...	Kalka, Ahir.
		Ahliyapur ...	Rohan.
		Marja ...	Manohar, Ahir.

Most of the large estates in the district have also considerable herds.

District.	Tahsil.	Village.	Name.
Bahraich ...	Nanpara ...	Cherba ...	Sauli and Farshad, Ahirs.
		Sujauli ...	Mt. Muna, and Hira Lal, Ahirs.
	Kaisarganj ...	Kaundar ...	Tilak Das and Fakire, Ahirs.
Mirzapur ...	Dudhi ...	Nadhra ...	Harbans, Brahman.
		Jaora ...	Harbans, Manjhi.
		Kudri	Runmar, Bania.
			Gopal, Manjhi.
		Dubha ...	Budhu, Ahir.
		Mahauli ...	Rantu, Manjhi,
	Robertsganj ...	Imlilokhar ...	Baghat, Gadaria.
		Sarsia ...	Chotu, Ahir.
Muzaffarnagar.	Muzaffarnagar.	Gadhawali ...	Lulla, Gujar and Nihal, Gujar.
		Puranwali ...	Rukha, Jat.
		Badshahpur	Makha, Gujar and Ram Baksh, Gujar.
		Badhewali ...	Umrao, Gujar.
Meerut ...	Mawana ...	Sarai Khadir,	Jahangir Singh.
		Bhan Bela ..	Kore, son of Dilsukh.
		Tajpura ...	Lala, son of Diwan.

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APPENDIX B.—VILLAGE BREEDING.

UPPER DOAB.

(*Muzaffarnagar, Meerut, Bulandshahr.*)

This tract may be divided into three portions, the uplands and the lowlands of the Jumna and the Ganges.

The uplands are characterised by the almost entire absence of grazing lands: cows are of superior quality (frequently of the Punjab type), but the number is very small and they are kept for milk, so that the young stock is often not properly nourished. There is not much prospect of a material increase in the number of cows in this tract: but the quality of the stock produced can probably be improved. In the first place the supply of bulls of the Punjab type is inadequate, and the cows covered by *desi* animals give very poor progeny: there is therefore scope for the supply of Punjab bulls.

In the second place, it is possible that the Jats (who own the best cows) would appreciate a development of the existing cattle shows, under which prizes would be given chiefly for the best cow and the best young stock, attention being paid to purity of breed, and (for young stock) to condition and development. In fact the shows should be developed on the lines of the horse shows which have undoubtedly enlisted the interest of the people, the idea being to secure the best possible quality of offspring from the good cows that are present in the locality.

The Jumna *khadir* contains extensive areas of land more suitable for cattle raising than for cropping: from the information available it appears that much of the land is controlled by Gujars who are not likely to allow it to be diverted to

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other purposes, but if any action is decided on in regard to preservation of grazing grounds, the whole of this area should receive special attention. The cows are usually of mixed Punjab type, and many are served by Punjab bulls when taken across the river for grazing: but more bulls of this type would be welcomed by the people. It is however doubtful whether much good can be done by government action in this tract. The people are more devoted to buffaloes than to cattle, and the profits of the *ghi* trade are such that they are unlikely to do anything that would interfere with it; while so many of them are interested in cattle theft that co-operation with government officers is out of the question. If the people would give up, or could be made to give up, this illicit occupation, the lowlands might be developed systematically for the production of both young stock and dairy produce; but while their habits remain as at present, they must be left to themselves.

There remain the Ganges lowlands, where there is at present a considerable surplus production of working cattle. There are a few large herds of cows (vide under professional breeding), but most are owned in small numbers by landholders and cultivators. The cows are described as a good type of *desi* animal: the young stock cannot compete with the Punjab bullocks that the richer cultivators prefer, but they are bought by those who cannot afford a larger animal.

The number of cows kept in this tract depends almost entirely on the area available for grazing. Special attention should therefore be given to it if any steps are taken for the preservation of grazing grounds.*

The supply of bulls is not satisfactory. Owners of considerable herds have goods bulls, but cows of smaller

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* Many of the Bulandshahr cows are taken over to Budaun for grazing as the present course of the Ganges leaves them little land on their own side of the river.

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owners are usually served by working bulls—many of inferior quality. Owners are opposed to the introduction of Punjab bulls, which they consider could not stand the life: they know the Kherigarh breed and are generally agreed that bulls of this type would suit their cows and would be able to live in the *khadir*. A few might be tried as soon as they become available, and if they establish themselves in popular favour, the supply should then be organised.

AGRA DIVISION.

(*Aligarh, Muttra, Agra, Mainpuri and Etah.*)

The supply of cows is very deficient throughout this division, and speaking generally there is not room for any large increase in the production of young stock. The uplands, which include most of the tract, have practically no grazing facilities, and where these exist they are used mainly for buffaloes.

There are a few good cows of western breed, kept by wealthy landholders and cultivators: as a rule there are no bulls suitable for these cows, and provision might be made, but not at the general expense. The bulk of the upland cows are very inferior: their needs are adequately met by sacred bulls in Muttra, but elsewhere the supply of these is inadequate. The quality of the cows is so poor that the organisation of a supply of bulls for them cannot be recommended at present.

The quality of the cows in Muttra is generally superior, there being a strong *Mewati* strain in them, and many of the sacred bulls are pure *Mewati*. The grazing along the Jumna is being devoted more and more to buffaloes, but there are still substantial numbers of cows in the lowlands in Chhata and Mat tahsils, where the grazing grounds should be preserved if any action in this direction is decided on.

The *khadir* in Etah (parganas Patiali, Nidhpur, Aulai and Faizpur) contains a large stock of *desi* cows of fair quality. It is at present reduced owing to changes in the course of the Ganges which have cut off large grazing areas, but the existing grazing grounds should be preserved if action is to be taken in this direction. In this tract the need of good bulls is exceptionally great. Sacred bulls are very rare, and there are few individual owners with resources sufficient to provide bulls for their own herds, though the aggregate number of cows would ensure this if they were in fewer hands. Organisation is therefore much wanted in this case. The people would not like Punjabi bulls: they ask for either good animals of the local type or else bulls of Kherigarh or Parehar. The latter might be tried when they are available, but in the meantime the supply of bulls of the local type is an urgent matter.

ALLAHABAD DIVISION.

(*Farrukhabad, Etawah, Cawnpore, Fatehpur and Allahabad.*

Two special areas may be noticed in the first place. The *khadir* in tahsil Qaimganj of Farrukhabad has a large stock of cows, and conditions in it are very similar to those in Etah. The grazing grounds should be protected in any general scheme, and the supply of bulls is a matter of much importance.

The trans-Jumna tract in Etawah, with the villages bordering the river on the north, used to carry a very large stock of cows. The stock was very seriously reduced by drought in the years 1905 to 1908, but is believed to be on the increase. The cows are of the "local" (*desi* breed), but of superior quality. The supply of sacred bulls is adequate, and their quality good. In this case general action to reserve the grazing grounds does not appear to be called for as it is most unlikely that they can be used for other purposes.

The rest of the division appears to contain no considerable areas where cattle are concentrated but more cows are kept by the people than is the case in the Agra division. The limited grazing areas in the Ganges *khadir* might be protected as part of a general scheme, but they are apparently much less important than those lying further west. There is no complaint of the numbers or quality of the sacred bulls, which suffice for the ordinary cows: the number of superior cows is relatively very small, and no general measures for supplying bulls can be suggested, though individuals may be assisted to get them when required.

JHANSI DIVISION.

(Banda, Hamirpur, Jhansi and Jalaun.)

All these districts carry a large stock of cows, mostly of inferior quality: there are no complaints of the insufficiency of grazing land, and no action to preserve it is called for at present.

The supply of bulls is reported to be inadequate in nearly all parts of the division. The practice of releasing sacred bulls is not followed, and very few of the cow owners are in a position to provide separate bulls for their herds. Organisation of the bull supply would improve the quality of the young stock and probably add substantially to the numbers available.

BENARES DIVISION.

With the exception of south Mirzapur, there are no extensive grazing areas in the division: the lowlands of the Ganges are fully cultivated. Consequently there are no localities where a stock of cattle is concentrated. The number of cows is small in the western districts, but increases eastward until in Ballia it is high, and—despite the want of grazing land—this district is almost self-supporting in the matter of cattle. The only apparent reason for this abnormal fact is the influence of the large Dadri fair: it is the custom for cultivators to sell young stock at it, and they appear to take more care of their calves than is the case in most other districts. The cows are of the local (*desi*) type and of moderate quality.

There appears to be a sufficiency of bulls throughout the division for the ordinary cows, and outside the cities there are very few cows of superior kinds.

Very large numbers of cattle are owned by residents in south Mirzapur. They are grazed during the rains in the local jungles but spend half the year in the Sirguja State as the grazing in Mirzapur is finished by about December. The country is fully stocked, and cannot carry a much larger number of cows. The breed is special, and cannot work in the plains : it finds its market in Chhota Nagpur. The grazing grounds are not threatened, and no action regarding them is required ; while as the cattle are practically useless to the United Provinces, it is unnecessary from this point of view to suggest methods of improving their value.

GORAKHPUR DIVISION.

The number of superior cows is very small indeed. There is on the whole a fair number of low grade cows in Gorakhpur, Basti, and the Sagri and Ghosi tahsils of Azamgarh : in the rest of Azamgarh the number is very small. Large herds are practically non-existent. The supply of sacred bulls is generally adequate.

The government and private forests are fully utilized for grazing, as also the smaller areas of uncultivated land on the Gogra. The private forests and *khadir* should be dealt with in any measures that are taken for reserving grazing areas.

Speaking generally the people are much more interested in making *ghi* than in rearing working stock, and buffaloes

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tend to replace cows: where cows are kept, the calves get an inadequate share of the milk.

SOUTH OUDH.

(Lucknow, Unao, Rae Bareli, Hardoi, Fyzabad, Sultanpur, Partabgarh and Bara Banki.)

The conditions over this large tract are on the whole very uniform. The number of cows of superior quality is very small; bulls suited to them would be a convenience to a few well-to-do men but would not materially affect the supply of working animals.

The number of ordinary cows is also small and there are no large owners with the exception of a few talukdars whose herds are not kept as commercial undertakings. Nor are the existing cows found to be collected in particular localities: some villages are found (notably in Bara Banki) where the cultivators (usually Kurmis and Ahirs) take special interest in cattle, and allow the young stock most or all of the milk, and these produce working cattle much above the average: but these villages are scattered irregularly over the country.

The supply of bulls is insufficient in the three western districts, but sufficient in the east, where sacred bulls are common. It is difficult to suggest effective means of supplementing the deficiency as the cows are not localised.

The only grazing grounds that have been recorded are—

(1) Some areas in the Ganges *khadir* in Unao.

(2) The Bazidnagar jungle in Hardoi (tahsil Shahabad).

(3) The *manjhas* on the Gogra in Fyzabad.

(4) Portions of the Gogra and Chauka lowlands in Bara Banki.

(5) The remnants of the Kandu Nala jungle in Sultanpur (tahsil Musafirkhana).

These should be dealt with if any action for preserving grazing grounds is decided on.

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It is fairly clear that the tract as a whole cannot carry a substantially larger number of cows in the present economic conditions.

WESTERN SUBMONTANE DISTRICTS.

(Saharanpur, Bijnor, Moradabad, Bareilly and Budaun.)

The stock of cows in these districts is largely concentrated in three groups of localities—

(*a*) in the vicinity of the submontane forests;

(*b*) along the Ganges;

(*c*) to a less extent along the Ramganga.

(*a*) The chief stocks are found in the following parganas:—

Saharanpur	... Jwalapur, Bhagwanpur, Faizabad and Muzaffarabad.
Bijnor	... Afzalgarh and Barhapura; also the north of tahsil Najibabad.
Moradabad	... The north of Thakurdwara.
Bareilly	... Chaumahla.

The number of cows in Saharanpur and Bijnor is apparently limited closely by the amount of grazing available in government and private forests: and in Saharanpur in particular owners generally assert that they would have much larger herds if they could get grazing for them, even if they had to pay higher fees. The tarai adjoining Bareilly does not appear to be so fully occupied.

The cattle may be called *desi* but they are somewhat superior: they would probably be much better if they had better bulls. Sacred bulls are rare, and comparatively few village cows can be covered by the bulls owned by professional breeders; and in most villages examined there was a clear demand for bulls as the individual owners are in too small a way of business to make adequate provision. The people are inclined to favour bulls of the Parehar or Ponwar breed. In Bareilly it is said that good bulls would induce owners to increase the number of cows.

(*b*) The chief stocks of cows along the Ganges are found (1) in tahsil Bijnor, (2) in tahsil Hasanpur of Moradabad, (3) almost throughout the *bhur* and *khadir* tracts in Budaun.

The cattle graze mainly in the *khadir*, but also in the *dhak* jungles of Dataganj (in Budaun) and on the borders of the Budaun and Moradabad districts (parganas Hasanpur and Rajpura). Considerable difficulty is found in feeding the cows when the *khadir* is flooded: while grazing on the land just after the flood has retreated appears to facilitate the spread of haemorrhagic septicaemia.

A few herds from Budaun are taken to graze in the Pilibhit forests, where the cows are covered by good bulls, and these herds are much superior in quality to the rest of the stock. The bulk of the cows are of ordinary quality, and there is throughout a scarcity of good bulls. Sacred bulls are rare, and only a few villages have provided bulls for joint use: in parts of Budaun bulls from the herds of wild cattle occasionally cover some of the cows, and the stock got is highly valued, but it is hardly possible to systematize this, and there is a general request for an organized supply of bulls. The Punjab type is not wanted: the people would like bulls of the Parchar or Ponwar breed, that is of the type that has improved the herds visiting Pilibhit.

There seems to be no doubt that the stock of cows in this tract has fallen off seriously and is still on the decline owing to the extension of cultivation in the *khadir*: much of this cultivation is exceedingly precarious, and probably the people as a whole would benefit by the worst land being given up.

(*c*) The stock of cows along the Ramganga is of less importance in Bijnor and Moradabad, while in Bareilly most

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of the grazing is occupied by buffaloes. Conditions are generally similar to those of the Ganges *khadir*, but on a smaller scale.

Central submontane tract.

This tract includes the most important areas of supply in the north of the province, viz. almost the whole of the Kheri district, tahsil Puranpur of Pilibhit and the north of tahsil Powayan in Shahjahanpur. There are also smaller areas with a fair stock of cows (*a*) in the north and north-east of Pilibhit tahsil; (*b*) in the north of Bisalpur, (*c*) in parts of tahsils Misrikh and Biswan of Sitapur.

The cows are as a rule much superior to the ordinary *desi* animal, but they are of very varying quality from the pure Kherigarh herds through the Ponwar and Parehar types, the *ganjrahi*, found chiefly in Shahjahanpur, and downwards to ordinary animals.

The number of cows is limited by the amount of grazing within reach of each locality, and has been reduced by the extension of cultivation.

There does not appear to be much demand for more bulls in the well-stocked parts of Sitapur, while in Kheri a demand exists in some villages but not in others. There is much demand for bulls of the Kheri types in Shahjahanpur and also in those villages of Pilibhit which do not send their cattle to graze at a distance: those that are so grazed are covered by suitable wild bulls at the grazing grounds.

The chief objection raised by owners to the grazing rules in the government forests is that the cows are confined to particular blocks and cannot change pasture so often or so freely as the owners consider desirable.

Gonda and Bahraich.

The northern parts of these two districts, and also the country along the Gogra and its tributaries, carry large stocks

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of cows. These are usually of the *desi* type, but two superior types known as *Nanpara* and *Risia* are distinguished by the people in Bahraich.

The supply of bulls is considered by the people to be adequate.

The largest stock of cows is found in parganas Tulsipur and Balrampur of Gonda, and tahsil Nanpara of Bahraich.

GENERAL.

The following list of villages where village breeding is important does not claim to be in any way exhaustive, but it contains enough names to indicate the localities where action can begin regarding grazing grounds and the supply of bulls :—

District.	Tahsil.	Villages.
Saharanpur ..	Roorkee ...	Bogawala, Bandajoo, Kurkawala.
	Saharanpur ...	Ismailpur.
Muzaffarnagar...	Muzaffarnagar	Badhewali, Jeki, Bhadauli, Alwipur, Dharmapur, Rajkalapur.
	Jansath ...	Bhukharheri, Kasimpur.
	Kairana ...	Rana Mazra, Khurgaon, Bihpur.
Meerut ...	Mawana ...	Sherpur, Sherzapur, Saraikhadir, Tarapur, Haripur, Bhan Bela, Chamrand, Ganeshpur, Kondhera.
Bulandshahr ...	Sikandrabad ...	Salarpur, Makanpur, Chappargarh.
	Khurja ...	Mahdipur Kalan, Palakha.
	Anupshahr ...	Farida, Mawai Hasangarhi, Thana, Sujana, Rasulpur, Safinagar, Fatehpur.
Aligarh ...	None recorded.	
Muttra ...	Mat ...	Mat, Jahangirpur.
	Chhata ...	Barha, Rampur, Basi Shirgarh, Garchi, Babugarh, Behta.
Agra ...	None recorded.	
Mainpuri ...	Ditto.	
Etah ...	Aliganj ...	Asokpur, Rustampur, Koroha, Rijhola, Barokha, Rai Damah, Sonorikhas, Nandauli, Khizrpur, Bati-ka-Nagla.
	Kasganj ...	Bastarpur, Tarapur, Roshannagar, Baznagar, Mankapur, Chandwa.
Bareilly ...	Baheri ...	Nazarganj, Richoli, Sirsa, Kathaunla, Raitwara, Amdanda, Jawaherpur.
Bijnor ...	Nagina ...	Rasulpur, Bamawala, Choharwala, Garhe, Tanda.

District.	Tahsil.	Villages.
Budaun	Gunnaur	Dhanari, Bah Bhur, Arthal, Mandauli, Ekona, Salanpur, Bhiranti, Dihpur, Karkora, Sikandarpur.
	Dataganj	Buksena, Jamalpur, Changasi, Sahjani, Bhagwatipur, Bairampur, Nabiganj.
Moradabad	Thakurdwara	Faridnagar, Rampur, Bathwakhera, Rajupur Milak.
	Hasanpur	Matena, Satera, Dhauriya, Dariyapur, Tigri, Pansara, Alinagar.
	Moradabad	Islamnagar, Mohabbatpur, Bhabakarpur, Bhojpur, Agwanpur.
Shahjahanpur	Powáyan	Haripur, Kishanpur, Hamirpur, Seramau, Gadha, Sultanpur, Sakhrana, Gulariya, Sundarpur, Manpur, Indarpur, Muradpur.
Pilibhit	Puranpur	Rampura, Harnathpur, Dhakhachat, may be quoted, but village breeding is almost universal in the tahsil.
Farrukhabad	Aligarh	Ugarpur.
	Qaimganj	Sadnagar, Sikandarpur Rao, Bahmai, Sikandarpur Tihays, Qamaruddinnagar, Bahlolpur, Gojarpur, Paharpur, Jijauta.
Etawah	Thana Sahson	Peprauli, Sahsaon, Chiranli, Sandos, Aseha, Pathera, Mithauli.
Cawnpore	Not recorded.	
Fatehpur	Khaga	Sultanpur, Ganeshpur, Sheorajpur, Karchutpur.
	Khajuha	Bukhanwai, Rustampur, Etmadpur.
	Ghazipur	Datauli.
	Fatehpur	Jamrawan, Sempur, Mirzapur.
Allahabad	Not recorded.	
Banda	Banda	Mattubarh, Hardaoni, Dawandi, Bamrauli, Ganjha.
	Karwi	Madian, Asoha.
Hamirpur	Kulpahar	Tulora, Murogpur, Pipri, Panwari, Raipur Khalsa.
	Mahoba	Jahrawa, Bhithar.
	Hamirpur	Khopti, Atraya.
Jhansi	Jhansi	Barwapurwa, Amernandia, Kailahar.
	Mau	Kanara, Qain Pachora, Pathargaon.
	Lalitpur	Naghera, Jharroi, Rajpura, Balabehat.
Jalaun	Kalpi	Nandi, Mawai, Bardaumukhi, Damaukhas, Chintamau.
	Jalaun	Sahan, Sukulpur Buzurg.
Benares	Not recorded.	
Mirzapur	Dudhi	Paraspani, Nawarganj, Bagmanda.
	Robertsganj	Lachmanpurwa, Utraulia.
Jaunpur	Not recorded.	
Ghazipur	Ditto.	
Ballia	Ditto.	
Gorakhpur	Gorakhpur	Gathar, Basantpura, Jaipur.

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District.	Tahsil.	Villages.
Basti	Basti	Rampur, Tikurya, Metha, Raiya.
	Khalilabad	Bilhar Kalan, Bilhar Khurd, Koshara.
Azamgarh	Ghosi	Chand Patti, Raunapur, Pakhupur.
Lucknow	Not recorded.	
Unao	Ditto.	
Rae Bareli	Ditto.	
Hardoi	Ditto.	
Sitapur	Misrikh	Bangawan, Neiri.
	Biswan	Amla, Pipariya Shabpur.
Kheri	Most villages.	
Fyzabad	Akbarpur	Rasulpur, Sadrpur.
	Fyzabad	Ankaripur Qazipur.
Gonda	Tarabganj	Andhu, Ratha Dalsingh, Damsarpur, Sadha, Basarya, Kardhiya.
	Gonda	Ametha, Jhumia.
Bahraich	Nanpara	Cherba, Mathi, Manjkora, Sujauli.
	Kaisarganj	Kaundar, Pura Pal Singh.
	Bahraich	Mohandnagar, Raubra.
Sultanpur	Not recorded.	
Partabgarh	Ditto.	
Bara Banki	Bara Banki	Sultanpur, Barel, Khandauli, Palhari, Dewa, Tikariya.
	Ramsanehighat	Parsa, Chaukhandi, Saidanpur.

APPENDIX C.

EXISTING GRAZING AREAS.

Tract.		*District.*	
Upper doab	(1) Jumna *khadir*.	Muzaffarnagar Meerut Bulandshahr	All existing grazing grounds in the *khadir*.
	(2) Ganges *khadir*.	Muzaffarnagar Meerut Bulandshahr	All existing grazing grounds in the *khadir*, and any reasonable extension that can be arranged.
Agra division		Muttra	Existing grazing grounds along the Jumna, especially in tahsils Chhata and Mat.
		Etah	Existing grazing grounds in the Ganges *khadir* (parganas Nidhpur Patiali, Aulai and Faizpur).
Allahabad division		Farrukhabad,	Existing grazing grounds in the *khadir* in tahsil Qaimganj (and possibly some small areas in the eastern tahsils).
		Cawnpore Fatehpur Allahabad	Such small areas as still exist in the Ganges *khadir*.
Gorakhpur division.		Gorakhpur Basti	The surviving private forests.
		Azamgarh	The grazing land available in the Gogra *khadir*.
South Oudh		Unao	Existing areas in Ganges *khadir*.
		Hardoi	Bazidnagar jungle (tahsil Shahabad).
		Fyzabad	Existing areas in Gogra *khadir*.
		Bara Banki	Existing areas in Gogra and Chauka *khadir*.

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Tract.	*District.*	
South Oudh—*concld.*	Sultanpur ...	The remnant of the Kandunaja jungle.
Western submontane.	Saharanpur Bijnor ... Moradabad Bareilly ...	Such private forests as exist in the submontane parganas.
	Bijnor ... Moradabad Budaun ...	Existing areas in the Ganges and Ramganga *khadirs*.
		The large *dhak* jungles in Rajpura and Dataganj (Budaun) and Hasanpur (Moradabad).
Central submontane.	Pilibhit ...	Existing private forests and pasture in (1) tahsil Puranpur, (2) the north of tahsil Pilibhit, (3) the north of Bisalpur.
	Shjahabanpur,	Existing forests and pasture in parganas Khutar and Powayan.
	Kheri ...	Existing forests and pasture throughout the district.
	Sitapur ...	Existing pastures along the Kathna (and any others there may be).
	Gonda ... Bahraich ...	(*a*) The Manjhas on the Gogra and its tributaries. (*b*) The private forests and pasture in parganas Balrampur and Tulsipur of Gonda and tahsil Nanpara of Bahraich.

APPENDIX D.

TRACTS WHERE BULLS ARE WANTED.

Upper doab	(*a*) Uplands	Bulls of Punjab or "western" breed (self-supporting).
	(*b*) Jumna *khadir*.	The same (if any action is to be taken).
	(*c*) Ganges *khadir*.	Good bulls of the local type: or Kherigarh bulls if experiment confirms the views of owners.
Agra division	(*a*) Uplands	Bulls of Punjab or "western" breed for the better class of cows (self-supporting).
	(*b*) Etah *khadir*	Local type: experiment with Kheri type.
Allahabad division	(*a*) Farrukhabad *khadir*.	(As in the adjoining Etah *khadir*.)
	(*b*) Uplands	A few western bulls may be wanted for the better class of cows (self-supporting).
Jhansi division		Organisation of the bull supply is wanted in all four districts and on a considerable scale.
South Oudh	Lucknow Unao Hardoi	Bulls are wanted throughout these districts, but the question of organising a supply is complicated.
Western submontane.	Saharanpur Bijnor Moradabad Bareilly	All along the submontane forests. The Parehar or Ponwar type should be tried.
	Bijnor Moradabad Bareilly Budaun	The Ganges and Ramganga *khadirs* require bulls almost throughout, but the need is specially great in Budaun. The Parehar or Ponwar type is asked for.
Central submontane.	Shahjahanpur,	Parganas Khutar and Powayan.

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Central submontane—*concld.*	Pilibhit	Parts of Puranpur and Pilibhit tahsils.
	Kheri	Some localities throughout the district. In these cases either Kheri or local bulls are wanted.

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Agricultural loans in famine years.

1. In preparing the district notes I have been led to examine the effect of the advances given in 1907-8, and the following remarks may be of some use on the recurrence of a season of severe distress.

2. The figures used in the following tables require a word of explanation. The first column gives the amount of advances for rabi (taken from statement IV of the famine resolution) calculated per 100 acres of the normal rabi area: this is a convenient unit as the object of the advances is to secure as nearly normal an area as is possible. The second column gives the total of kharif suspensions and remissions (table III of the resolution) in terms of the same unit, and the third gives the total of these two. In other words, the first column gives the sum that Government put into circulation, the second gives the sum that it refrained from trying to take out and the third is the total assistance given in the way of working capital.

3. The next column gives the normal rabi area per masonry well. This figure is significant mainly in south Oudh and in the eastern districts as indicating the existing facilities for flushing the land: given equal facilities for making temporary wells, the area actually sown may be expected to vary with the supply of wells already present. In the doab the significance of this figure is masked by the presence of canals, and in Bundelkhand and much of the submontane tract the number of wells is too small to make an appreciable difference.

4. The next column shows the proportion of the normal area sown as the result of the conditions stated in those that precede it: but in a few cases the area was also affected by rain in September, and where the falls exceeded half an inch they are shown in the remarks column.

5. The last three columns are interesting as showing the changes in cropping. The people know well that gram does worst and cereals best in a famine seed-bed, and the changes in the proportions of these crops give distinct indications of shortage of capital. For the province as a whole the gram yield in 1908 was only 60 per cent. of the normal, while the cereals yielded 75 to 85 per cent., and it is obviously desirable that the people should be able to sow cereals on a much larger proportion of the land than is usual. To obtain the figures given, the percentage of the normal was calculated for the rabi of 1907 (itself a normal season) and of 1908, and the difference between the percentages (with the appropriate sign) is shown in the tables.

6. The first table shows the Bundelkhand districts, and (by way of contrast) the severely distressed districts of north Oudh :—

District.	Assistance.			Area per well.	Rabi sown for 1908.	Changes in proportion of—			Remarks.
	Advances.	Suspensions and remissions.	Total.			Wheat.	Barley.	Gram.	
	Rs.	Rs.	Rs.	Acres.	Per cent.				
Jalaun ...	29	74	103	...	23	+4	+9	−10	
Banda ...	34	78	112	...	33	+7	+2	−11	
Hamirpur	32	105	137	...	32	−7	−9	+9	
Jhansi ...	44	113	157	...	45	+4	+12	−21	
Sitapur ...	142	38	180	145	55	−6	+15	−12	
Kheri ...	121	83	204	241	48	−11	+21	−9	
Gonda ...	137	109	248	24	53	+2	+8	−6	77 cents rain in September.
Bahraich...	38	31	69	67	58	...	+9	−11	95 "
Bara Banki	144	92	236	38	61	+8	+5	−31	

7. There is not much to be learned from the figures for Bundelkand because the area that can be flushed is so small: Jalaun might have secured a larger area, but the supply in the Betwa canal was low.

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Hamirpur alone of any district in the province grew proportionately more gram and less cereals: it is well-known that the seed-supply is less organized here than elsewhere, and the two facts are probably connected.

8. In the Oudh districts the small amount of assistance given to Bahraich stands out prominently, and it is perhaps significant that the proportion of wheat did not rise as in Gonda and Bara Banki.

It seems probable that in an equally severe drought these Oudh districts will require rabi advances at about Rs. 150 per 100 acres. The Bundelkhand districts will need less, but their needs will grow as the water-supply increases, and probably Rs. 50 will be the approximate demand.

9. The next group shows the rest of Oudh, the entries for Bara Banki being repeated :—

District.	Assistance.			Area per well.	Rabi sown for 1908.	Changes in proportion of—		
	Advances.	Suspensions and re-missions.	Total.			Wheat.	Barley.	Gram.
	Rs.	Rs.	Rs.	Ares.	Per cent.			
Lucknow ...	210	108	318	20	67	+6	+8	—22
Unao ...	90	147	237	23	68	—4	+14	—11
Rae Bareli...	85	68	153	12	77	—1	+6	—11
Hardoi ...	69	77	146	75	60	—13	+21	—12
Fyzabad ..	77	89	166	12	71	+2	+7	—14
Sultanpur ..	76	123	199	15	71	...	+10	—16
Partabgarh	52	78	130	14	75	—2	+24	—14
Bara Banki	144	92	236	38	61	+8	+5	—31

It will be seen that the total assistance and in particular the amount of advances, varied considerably; the facilities for flushing also differ greatly in different districts, and if the districts are arranged in the order of facilities, it is practically the order of rabi area: Fyzabad, Sultanpur, Partabgarh and Rae Bareli have an existing well to from 12 to 15 acres of

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rabi; Lucknow and Unao have a smaller number of wells and Bara Banki and Hardoi are much worse off. The figures do not suggest that any district received inadequate assistance compared to its neighbours so far as the area sown is concerned.

10. The class of cropping does, however, indicate certain significant facts. While all districts reduced the area under gram, the least desirable crop in a drought, the reduction was proportionately greatest in Lucknow and Bara Banki, where advances were largest, and these two districts alone secured a subtantial increase in the proportion of wheat; elsewhere the people were content with barley. The figures suggest that in a season as bad as 1907 these eight districts of Oudh may want advances for the rabi from Rs. 100 to Rs. 150 per acre of normal cultivation.

The figures also bring out strongly the need for more masonry wells or other stable sources of supply, not only in Hardoi and Bara Banki but also in Lucknow and Unao. This point has already been dealt with in the district notes.

11. From Oudh we pass to Rohilkhand: the Hardoi figures are repeated, as the district is in many respects more like Rohilkhand than Oudh:—

District.	Assistance.			Area per well.	Rabi sown for 1908.	Changes in proportion of—		
	Advances	Suspensions and remissions.	Total.			Wheat.	Barley.	Gram.
	Rs.	Rs.	Rs.	Acres.	Per cent.			
Bareilly ..	95	90	185	360	68	—5	+9	—8
Bijnor ..	76	112	188	321	69	+6	+10	—13
Budaun ..	60	46	106	90	80	—10	+11	—3
Moradabad ..	45	53	98	395	72	—4	+10	—7
Shahjahanpur	87	47	134	411	75	+2	+10	—14
Pilibhit ..	62	67	129	347	56	+5	+9	—16
Hardoi ..	69	77	146	75	60	—13	+21	—12

In these districts the number of masonry wells is so small as to be irrelevant, while there is some canal irrigation in Bareilly, Bijnor and Pilibhit. The districts which sowed the smallest rabi area are Pilibhit and Hardoi; but making allowance for differing agricultural conditions it appears likely that, except possibly in Budaun, all these districts could have done better with more money, while Budaun could probably have secured a better proportion of wheat.

The figures suggest that in Rohilkhand about Rs. 100 per 100 acres of normal cultivation can be advantageously advanced in a similar calamity.

12. The next table shows the upper half of the duab, but Mainpuri is omitted as I have found reasons to think that the figure selected for the normal rabi area is unsuitable in its case: the figure for Etah, too, is open to some suspicion, the reason in both cases being that owing to the settlement complete figures were not available for the typical years on which the normals rest :—

District.	Assistance.			Area per well.	Rabi sown for 1908.	Changes in proportion of—		
	Loans.	Suspensions and remissions.	Total.			Wheat.	Barley.	Gram.
	Rs.	Rs.	Rs.	Acres.	Per cent.			
Saharanpur...	32	15	47	87	81	+8	+6	—19
Muzaffarnagar	12	24	36	51	85	+9	+2	—19
Meerut ...	49	45	94	43	72	+3	+8	—21
Bulandshahr	5	6	11	37	74	—13	+11	—9
Aligarh ...	36	25	61	36	75	—17	+17	—2
Etah ...	62	31	93	25	83	—16	+13	+1
Muttra ...	135	116	251	47	67	—10	+22	—15
Agra ...	206	151	357	29	77	—5	+19	—18

The area per well is in this tract a minor factor owing to the lage amount of canal irrigation. The figures seem to

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indicate that both Bulandshahr and Aligarh could have sown a larger area with more money, and need not have lost so much of their wheat, while Etah could with advantage have had more to buy wheat.

Muttra did very badly and possibly advances on the very large scale adopted in Agra might have obtained better results, but the position of this district is difficult. Probable requirements in a similar calamity are—

Saharanpur	Rs. 20 to Rs. 40 per 100 acres.
Muzaffarnagar	
Meerut	„ 50 per 100 acres.
Bulandshahr	„ 75 „ „
Aligarh	
Mainpuri	
Etah	
Muttra	„ 200 per 100 acres.
Agra	

13. The next table shows the rest of the plains; Allahabad is omitted because it is too composite to argue about as a unit, and Mirzapur because the famine statistics relate to a larger area than is covered by those of crops; the figures for Azamgarh are incomplete owing to settlement operations:—

District.	Assistance.			Area per well.	Rabi sown for 1908.	Changes in proportion of—			Remarks.
	Advances.	Suspensions and remissions.	Total.			Wheat.	Barley.	Gram.	
	Rs.	Rs.	Rs.	Acres.	Per cent.				
Farrukhabad	71	13	84	37	76	−13	+12	−6	
Etwah ...	75	84	159	47	75	−10	+8	−6	
Cawnpore ...	40	68	108	37	67	−4	+6	−3	
Fatehpur ...	29	64	93	22	75	−3	+2	−1	
Benares ...	36	8	44	14	81	−5	+7	−4	1·18" rain in September.
Jaunpur ...	47	12	59	12	85	−4	+9	−5	
Ghazipur ...	44	23	67	20	78	−3	+6	−1	2·18"
Ballia ...	74	11	85	21	84	−5	+5	...	4·90"
Azamgarh ...	63	88	151	14	85	Not available.			2·43"
Gorakhpur ...	8	2	10	26	78	+2	+10	−6	4·69"
Basti ...	27	18	45	19	73	+4	+5	−4	3·05"

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The low area sown by Cawnpore is noticeable in the first group, while all districts in it show less wheat and more gram than is desirable, indicating scarcity of capital.

In the second group the area follows generally the well facilities, but Ballia had exceptional rain; Ghazipur also benefited as compared with Jaunpur and should have had a larger area.

The third group might apparently have obtained a substantially larger area with more capital distributed.

For these three divisions taken together the demand may be expected to vary between Rs. 75 and Rs. 100 per 100 acres in a calamity of equal magnitude.

14. In round numbers then and allowing for the hill districts, it appears that over two crores, and possibly as much as 2½ crores, can be distributed with advantage in a calamity as severe as that of 1907 for sowing the rabi alone: the distribution of 1¼ crores in 1907 was a tremendous advance on anything that had previously been done, and it is safe to assume that the people will be ready to take much more money as the result of those operations, so that, assuming the money to be available in the treasuries, the organization for distributing it will have to be very carefully thought out. It is needless to add that joint responsibility must be the essence of the organisation.

This conclusion is not of permanent application: the ordinary supply of agricultural capital may be expected to increase steadily with the spread of the co-operative organisation, but so far as can be judged the need for several years to come will be on the scale that has been indicated.

15. It is probable that in a large number of districts advances can be given most usefully for planting sugarcane and sowing *zaid* crops, but they will not be on a scale comparable to that for rabi sowings, and data are wanting to

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calculate the probable amount. In 1908 advances for sugarcane aggregated 1⅓ lakhs, but this was only for ten districts, in three of which the amount was nominal.

Advances for *zaid* crops are not shown separately in statement IV of the famine resolution, and they are probably included under rabi advances: I remember well the success that was attained in Sultanpur in 1897 by the efforts to facilitate the growth of *sawan*, and when south Oudh is short of food the point is one of substantial importance.

Probably then some lakhs of rupees can be given with advantage in the early spring, partly in the cane tracts and partly in the districts where cultivators understand the needs of the *chena* or *sawan* crop.

Lastly, as to advances for the ensuing kharif. In 1908 these varied within very wide limits; no advances were made in Saharanpur, Jaunpur or Gorakhpur, while over one rupee an acre was given in Mirzapur and nearly 1½ rupees in Gonda and Bahraich. The districts which failed to sow an area substantially in excess of the normal are shown below :—

	Area sown.	Advances (in rupees per 100 acres).
Saharanpur	95	...
Muzaffarnagar...	97	8
Muttra	88	3
Agra	95	28
Mainpuri	96	7
Pilibhit	97	19
Allahabad	98	19
Hamirpur	100	48
Banda	96	56
Jaunpur	96	...
Ballia	99	7
Azamgarh	96	11
Rae Bareli	99	46
Fyzabad	100	24
Sultanpur	98	43

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There were obvious difficulties in growing late rice, but it appears probable that all these districts, except Banda, Hamirpur, and possibly the three last entered, could have employed more capital with advantage. The provincial total was 78 lakhs, and probably about a crore should suffice in the next emergency.

W. H. MORELAND,

Director of Land Records and
Agriculture, United Provinces, on special duty.

The 13*th June* 1912.

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Movement of rent rates.

1. The amount of the income derived from agriculture which is claimed by landholders can best be measured by the all round rent rate, which is obtained by dividing the recorded rental of a district by the area to which it relates after excluding the figures for those classes of privileged tenures which are separately recorded. The amount of this rate in any given year is a point of much less importance than the rate of its growth, and the following figures have been compiled in order to give some idea of this factor in the economics of the province. They are incomplete: there are no rental statistics for Kumaun, and Bundelkhand rents are immaterial: the records of Gorakhpur and Basti (while still faulty) have been so much improved in the period under review that no inferences can be drawn: Dehra Dun, Mirzapur, Ballia and Muttra are excluded for special reasons connected with the statistics; while owing to settlement proceedings or other causes complete figures are not available for Agra, Moradabad, Mainpuri, Cawnpore and Azamgarh. The period taken extends from 1904-5 to 1910-11 and includes one great frost and two droughts, so that conditions for enhancing rents were on the whole unfavourable.

Division.			Rent rate in—		Increase.	Annual rise per cent.
			1904-05.	1910-11.		
			Rs.	Rs.		
Meerut	4	districts ...	6·48	7·15	0·67	1·7
Agra	2	,, ...	5·68	6·25	0·57	1·6
Rohilkhand	5	,, ...	4·29	4·59	0.30	1·1
Allahabad	4	,, ...	4·58	4·75	0·17	0·6
Benares	3	,, ...	4·74	4·82	0·08	0·3
Oudh	12	,, ...	5·83	6·18	0·35	1·0

2. In Meerut there are marked differences: the average annual rise is only 1·2 in Bulandshahr and 1·3 in Muzaffarnagar,

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while it exceeds 2·0 in Saharanpur and Meerut. In Aligarh the rate is 1·6, while in Etah it reaches 2·4, the highest in the province: rents there are however very low, and the rise appears to represent a process of levelling up.

3. In Rohilkhand Budaun also has a rate of 2·2 due to the same cause: rents in Pilibhit have not moved, while in the rest of the division the rate lies between 0·8 and 1·0. In Allahabad, Fatehpur shows no movement and Allahabad (owing to the trans-Jumna tract which resembles Bundelkhand) has only a small increase: the remaining districts have rates of 0·9 to 1·1.

4. The rates in Benares are uniform, but Oudh is very irregular, varying from 0·2 in Sitapur (following a period of very rapid enhancement) to 1·8 in Lucknow and 1·7 in Unao and Hardoi.

5. So far as the divisions of Agra are concerned the present rate of increase is in accordance with what might be expected from a knowledge of the existing conditions, there being on the whole a natural gradient from Meerut to Benares which is reproduced in the figures: as regards Oudh the position is more anomalous as, making every allowance for the development of the northern districts, one would hardly expect the rents (initially much higher) to rise as rapidly as those of Rohilkhand.

6. The following comparison of the rate of rise in border districts is of interest, but of course the natural features of the country prevent any very definite conclusions being drawn from the figures.

Oudh border.		*Agra border.*	
Kheri	1·1	Pilibhit	0
Hardoi	1·7	Shahjahanpur Farrukhabad	0·9 1·1
Unao	1·7	Cawnpore (a)	0·9
Rae Bareli	1·0	Fatehpur	0
Partabgarh Sultanpur	0·7 0·5	Jaunpur	0·3

(a) The Cawnpore rate is calculated on six years instead of seven for this comparison, as figures for the first year are not available.

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In this connection the provisions of the Oudh Rent Act require consideration. The Act limits enhancement to 6·25 per cent. with a rest of seven years. Hence on the assumption that every holding in a district was enhanced to the maximum in a given year, the rent rate of the district would show a rise of 6·25 per cent. over that of the previous year and could not rise again for seven years, assuming (what is at present true except in Kheri) that cultivation was fairly constant. (Extension of cultivation would ordinarily lower the average rate, while reduction would raise it.) The case stated is not realised in practice, but the fact remains that in any period of seven years if the law is observed the average rent rate cannot rise by more than 6·25 per cent.: or in other words the average annual rise should not exceed $\frac{6\cdot25}{7}$ = say 0·9 per cent.

7. It has been shown above that for the whole of Oudh the *average* annual rise has been at the rate of 1·0 per cent. or more than the *maximum* rise permitted by the law: this is conclusive proof that the provisions of the Act have been disregarded in a large proportion of the individual tenancies and not merely in occasional instances; while, if account is taken of the landholders who observe the law, it is obvious that in large numbers of cases the excess enhancement must have been very large.

8. In order to obtain further information I have tabulated the average annual rise for the entire period since settlement (which varies by districts), taking the first year for which figures were received, calculating the percentage of rise in the period, and dividing this by the number of years. The figures are :—

District.	Average annual rise since settlement.		Average annual rise.
	Number of years.	Average rise.	1312-1318.
Lucknow	15	1·4	1·8
Unao	16	1·0	1·7

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District.	Average annual rise since settlement.		Average annual rise
	Number of years.	Average rise.	1312-1318.
Rae Bareli	14	1·2	1·0
Sitapur	13	1·1	0·2
Hardoi	12	1·2	1·7
Kheri	11	2·8	1·1
Fyzabad	15	0·7	1·2
* Gonda	7	0·6	0·7
Bahraich	12	1·4	1·1
Sultanpur	12	1·0	0·5
Partabgarh	16	0·8	0·7
Bara Banki	15	1·3	1·3

The Act does not apply to parts of Kheri, and has been varied for the Ajodhya estate: this last may have affected the Fyzabad and Gonda figures for the latter period.

9. The figures seem to me to justify the conclusions that:—

(1) There has certainly been widespread enhancement beyond legal limits since settlement in:—

Lucknow, Bahraich,
Bara Banki

and the same has occurred to a less extent in:—

Unao, Sitapur,
Rae Bareli, Hardoi,
Sultanpur.

(2) The rate of enhancement has slackened significantly in Sitapur, Kheri and Sultanpur, where enhancements were snatched after settlement:

it has remained more or less constant in:—

Rae Bareli, Partabgarh,
Bahraich, Bara Banki;

it has increased materially in:—

Lucknow, Hardoi,
Unao, Fyzabad.

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* The two periods are almost identical in Gonda.

The recent rise in Fyzabad may be due in part to enhancements on the Ajodhya estate, but there is no similar explanation in the case of Lucknow, Unao and Hardoi, which it may be noted lie together.

10. There is no doubt then that the provisions of the Oudh Rent Act regarding enhancement are a dead letter over large portions of the country. The question whether the unrestrained enhancements already made are such as to reduce the productive power of the cultivators affected cannot be answered by figures because there has not yet been time for the effect to manifest itself: but if there be any truth in the theory that while productive power depends on security of tenure, security of tenure necessarily involves some external limitation on rents, then the position in Oudh is so unsatisfactory that to my mind there should be no delay in taking up the question of giving the tenant the protection which he requires, not merely in his own interest but in that of the landholders and of the whole community.

11. It would be going beyond the scope of this note to indicate the legislative or administrative changes that are required, which can be determined only after minute enquiries and prolonged discussion, but it may be suggested that a rent law framed to meet the special conditions on *talukdari* estates can never give adequate protection to cultivators holding under other classes of landholders, and that taking together the *zamindari* and *pattidari* villages and those held in sub-settlement the aggregate of such cultivators is far too important to be overlooked. From the statistics given in the last series of settlement reports I calculate that only about 53 per cent. of the area of Oudh is managed directly by talukdars, and 47 per cent. is managed by men who have no share in talukdari traditions; while in Lucknow, Unao and Hardoi three-fourths or more of the land is in the hands of ordinary zamindars or pattidars. The fact that these three districts show much the largest rate of enhancement in recent years

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may be accidental, but it is a commonplace of the settlement reports* that *talukdari* rents are lower than others, and it is possible that the coincidence is significant.

12. As regards Agra the position is more complex: a large proportion of the land is held in occupancy rights at rents which are much below the competition rate, and there is no question of these rents being generally excessive: in fact they are in some cases so low as to tempt the larger occupancy tenants to sublet. Competition rents on the other hand are rising everywhere except in Bundelkhand, and in the west the rise is very rapid.

13. A wide divergence between occupancy and competition rents has serious drawbacks: it may threaten the occupancy system as a whole owing to the increased hostility of landholders: it may produce the evils admittedly resulting from sub-letting (whether open or clandestine); and it may react injuriously on the productive power of the community.

14. The following figures have been brought together to show the extent of this divergence and the rate at which it has increased in recent years. The actual competition rents are not separated in the statistics from the rents paid by unrecorded occupancy tenants, and the rate is therefore understated in the case of districts where the settlement has been running for some time; the divergence is thus greater than the figures show :—

District.	1318.		Percentage of occupancy to other rate.	
	Occupancy rate.	Other tenants' rate.	1312	1318
Saharanpur	4·4	7·0	72	63
Muzaffarnagar	4·6	8·6	58	53
Meerut	5·6	10·4	60	54

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* The reports do not indicate whether payments by way of *nazarana* to the talukdar and his agents are such as to bring the tenants' total payments up to the higher level.

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District.	1318		Percentage of occupancy to other rate.	
	Occupancy rate.	Other tenants' rate.	1312	1318
Bulandshahr	5·1	9·1	60	56
Aligarh	6·0	9·1	72	66
Mainpuri	4·9	6·5	81*	75*
Etah	4·3	4·9	95	87
Bareilly	4·5	6·1	85	74
Bijnor	5·6	6·9	86	81
Budaun	3·5	5·0	85	70
Shahjahanpur	3·6	4·0	100	90
Pilibhit	4·3	3·5	127	123
Farrukhabad	4·5	4·9	107	92
Etawah	5·1	6·0	91	85
Fatehpur	4·6	4·8	98	95
Benares...	4·3	5·8	75	74
Jaunpur	4·9	5·4	92	91
Ghazipur	4·0	5·7	73	70
Azamgarh	5·4	5·5	?	98

15. It will be seen that the divergence at the present time decreases down the doab. In the Meerut division occupancy rents are from 53 to 63 per cent. of other rents, in Agra from 66 to 87 and in Allahabad from 85 to 95. In Rohilkhand the case of Pilibhit is exceptional as rents are scarcely moving; in the rest of the division conditions approximate to the middle doab. In the four eastern districts given, the divergence is irregular. That there must be a strong temptation to sublet in particular cases, in the upper doab is evident from the fact that the "average" tenant can see a clear income of four rupees an acre or more; and in Meerut, where the divergence is greatest, the occupancy tenant can look for Rs. 4·8 while his landholder has Rs. 5·6.

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* Rate in 1314F.

16. The rate at which the divergence is growing can be seen from a comparison of the figures for 1312 and 1318. These may be summarized as follows :—

Division.	Proportion of occupancy to competition rate.		Fall in the period.
	1312	1318	
Meerut	62	57	5
Agra	73	67	6
Rohilkhand	87	80	7
Allahabad	101	95	6
Benares	80	77	3

In the first four divisions it will be seen that the divergence has grown uniformly, the proportion falling by about one unit a year : in Benares the movement is considerably less and there is some cause at work there retarding the rise of competition rents.

17. The permanent settlement naturally suggests itself. So far as occupancy tenants are concerned, this probably does retard the rise of rents because there is no periodical levelling up such as takes place at a revision of settlement. This cause however would operate to increase the divergence as the occupancy rate would not rise : but the point is that neither occupancy nor competition rents are rising as fast as further west. In this case it seems fair to draw a comparison between Ghazipur and Jaunpur on the one hand and the adjoining temporarily settled district of Azamgarh on the other. They have most economic features in common, while the inaccuracies in the record of rents are probably of the same order of magnitude.

The rates for 1318 stand as follows :—

District.	Occupancy rate.	Competition rate.
Jaunpur	4·9	5·4
Ghazipur	4·0	5·7
Azamgarh	5·4	5·5

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The effect on occupancy rents of a revision of settlement is apparent in the case of Azamgarh, where these rents were levelled up a few years ago; but the competition rate there shows no greater movement than in the permanently settled districts, and is apparently determined by the same forces. If this condition continues during the next few years, it will go far to show that the permanent settlement does not affect the competition rate; while if the rate rises much more rapidly in Azamgarh than in Jaunpur and Ghazipur, there will be evidence in favour of the contrary conclusion.

18. There are however causes other than the permanent settlement at work. The pressure on the land, though still very great, is lessening with the decrease in population, as the following figures show:—

Population in—	Jaunpur.	Ghazipur.	Azamgarh.
1891	1,265,000	1,025,000	1,729,000
1901	1,203,000	914,000	1,530,000
1911	1,156,000	840,000	1,493,000

Agriculture is not progressive: the reduction in the area of sugarcane and indigo has not been made good by the extension of other market crops, and if rents should rise it seems probable that the increase will be paid from earnings outside the districts, which as a matter of fact already contribute largely to the collections. Allowance must also be made for the fact that the area held without declared rights, on which the competition rate is calculated, forms a much lower proportion of the total holdings area in the eastern districts than in the rest of the province. It is about 18 per cent. in Ghazipur and Azamgarh, and falls as low as 12 per cent. in Jaunpur, as against from 31 to 37 per cent. in the three western divisions. Most of the productive land is held by

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proprietors or by fixed rate and occupancy tenants, and the scope for enhancement on the remainder is correspondingly reduced. Finally the records are probably further from the truth in the eastern districts than elsewhere, and it may be that the true rise in rents is in part obscured by understatements. While then evidence from Azamgarh must be awaited, there appear to be sufficient reasons to account for the slow growth of competition rents in the east without invoking the influence of the permanent settlement.

19. Apart from the eastern districts, the divergence between occupancy and competition rents appears likely to increase steadily in the existing economic conditions. It will be reduced as each district comes under settlement, but recent experience suggests that the settlement courts will not usually bring the occupancy rents close to those paid by other tenants; the following figures show the rates recorded in the first year after some settlements recently concluded :—

District.	Year of record.	Occupancy rate.	Competition rate.	Initial divergence.
		Rs.	Rs.	Rs.
Meerut	1308	5·3	8·3	3.0
Aligarh	1311	5·8	7·8	2·0
Mainpuri	1314	4·7	5·8	1·1
Etah	1312	4·0	4·2	0·2
Bareilly	1311	4·5	5·1	0·6
Moradabad ...	1317	4·1	6·5	2·4

So far as I have been able to ascertain, there are two main causes at work to maintain the increase in the divergence. One is the habit of the people to regard occupancy rents as fixed for the term of settlement: the other is the difficulty of raising the standard of these rents. The following examples are taken of districts where the rates are substantially comparable over a series of years:—

District.	Year.	Occupancy rate.	
		Then.	Now (1318).
Saharanpur	1302	4·1	4·4
Muzaffarnagar	1302	4·4	4·6
Bulandshahr	1302	4·6	5·1
Agra	1302	4·5	4·6
Bijnor	1307	5·6	5·6
Shahjahanpur	1309	3·5	3·6
Etawah	1302	4·9	5·1
Fatehpur	1301	4·4	4·6

It will be seen that the rise is substantial only in Bulandshahr (where of course it falls far short of the rise in competition rents).

20. The second cause, the difficulty of raising the standard of rents to follow changes in economic conditions, requires a few words of explanation. The rent courts can raise the standard only on the ground of a rise in the local prices of agricultural produce: I have no recent personal experience of litigation of this kind, but I am informed that cases fail very frequently because the landholder is unable to discharge the burthen of proof; he has to show not merely the fact but the extent of the rise, and the difficulties in his way are obvious.

21. If it is considered that the divergence between occupancy and competition rents is likely to grow to such an extent as to involve risk either to the occupancy system or to the productive power of the country, action might in theory be taken either to check the competition rate or to facilitate the rise of the occupancy rate. The latter course would involve either a change in legislation substituting some more tangible criterion for enhancement for that at present adopted,

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or some administrative change, whether a reduction in the term of future settlements bringing a more frequent reconsideration of rent rates, or the provision of some machinery by which the extent of a change in prices could be more easily established. So far as can be foreseen the rate of economic change is likely to accelerate, and a greater degree of elasticity may be required in the near future if it is not already desirable: and the fact should not be overlooked that change may take place in one direction as well as another, and that a more elastic system may be needed in the interests of tenants as well as in those of landholders.

W. H. MORELAND,

Director of Land Records and
Agriculture, United Provinces, on special duty.

Dated June 1912.

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Cattle-supply and grazing land.

I.—INTRODUCTORY.

IN considering an economic complex in its dynamic aspect there is a very real danger of neglecting the secondary reactions that follow on any change in the intensity of the forces at work. It is convenient in economic discussion to trace the working of a single force on the assumption that other things remain equal; but when the discussion is meant to result in action, it is necessary to remember that other things do not remain equal, but that each separate force has reactions with the other forces at work, and that the whole of them tend to produce an equilibrium which is usually very different from that which would appear to result from the consideration of a single force. It seems to me that the secondary reactions have been very frequently ignored in dealing with the large group of questions connected with the supply and the feeding of agricultural cattle; and that many schemes of doubtful utility and more than doubtful practicability have been put forward, because the tendencies already at work have been overlooked, and there appeared to be a necessity for violent interference which did not in fact exist.

2. The views which I have been led to take may be stated shortly as follows :—

(1) the practical equilibrium hitherto existing between supply and demand is being disturbed by the intensification of certain forces :

(2) the intensification of these forces is in itself a matter for satisfaction ; and even if it were not, it could not be prevented by government action :

(3) the secondary reactions which are being produced are tending to restore equilibrium :

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(4) while, however, Government need not, and cannot, interfere with the main tendencies at work, something can, and should, be done to make the transition as easy as possible, and to ensure that during the inevitable disturbance nothing of permanent value is lost to the country.

3. The justification of these views will, I fear, be a somewhat lengthy process: my apology must be that their truth or falsehood is a matter of vital importance, and that a large portion of the economic complex must be passed under review if the secondary reactions are to receive the attention that is due to them.

II.—THE EXISTING EQUILIBRIUM.

4. It it not of course possible to point to any precise period as exhibiting in its perfection the equilibrium that is now being disturbed, because the disturbance is itself a gradual process; but speaking broadly there is practical equilibrium at the present time if we consider the area of these provinces, excluding the Himalayas and including the adjoining parts of Central India and Rajputana. Within this area cultivators can get the cattle they require at prices which they are able to pay, and—leaving famines out of account—they can feed the cattle they keep. It does not seem necessary to adduce evidence in support of these two propositions: no doubt it would be possible to point to particular areas where they are not for the moment true: but their general truth is borne out by a mass of statistics that cannot be disregarded, and will not be disputed by any one who knows the province as a whole. Were either of them generally false, the returns of cultivated area and of revenue collections (to go no further) would afford early and conclusive evidence. The question has come into prominence because of apprehensions based on observation of particular areas (such as the Muzaffarnagar lowlands) that if the present

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movement continues there will not be enough cattle, or there will not be enough to feed them.

5. It is worth while to point out here that the equilibrium of food to cattle is not an accident or a spontaneous adjustment, but is the result of conscious processes. Cultivators as a rule neither buy nor sell fodder; they know what they can expect to obtain from the common waste, and they plan their crops in such a way that the yield of fodder (whether principal or secondary product) together with the yield of the waste, will make up their requirements. In the days when I was learning the rudiments of the agricultural economy of the province from the mouths of cultivators, my suggestions that money could be made by altering the system of cropping (e.g. by substituting cotton for millet) were often met by the sharp rejoinder: "And what would the bullocks eat"? So long as the cultivators' calculations are not upset, the equilibrium between food and cattle is thus consciously maintained: it is disturbed only when drought or some other calamity brings the calculations to nought.

6. The practical equilibrium of fodder supply does not exist only with reference to the number of efficient cattle required for tillage: there are also the cattle that are past regular work for which there is no regular market, and which are protected from destruction by a religious sentiment humane in its origin though resulting in a large amount of suffering. These cattle are not wholly unproductive, or rather it is impossible to draw a line between useless and productive animals. Though past regular work, they have to help when work is pressing and it is a common sight to see an almost worn-out bullock taking a short turn at the well while an efficient bullock has a rest. The existence of this body of spent cattle presses on the grazing grounds and involves the production of a larger area of fodder-yielding crops than would be necessary if inefficient cattle could readily be disposed of. Possibly, however, their importance has been overrated: at

the last cattle census there were only 233 working cattle (including the inefficient and also cart bullocks) to 100 ploughs and the margin to allow for sickness and interruptions is perhaps not very excessive. Whatever the excess may be, it is reduced for the time being on every occasion when the cultivators' calculations are upset, since there is, I think, no doubt that when food is in defect the best cattle get what there is and the worst are sold or starve.

7. Such, then, is the existing equilibrium. No one would say it is entirely satisfactory: there is little reserve to meet accidents of season: a better class of cattle would be more economical in many places: and the poor man's cattle share the privations of their owner when times are at all hard. The best that can be said for it is that, on the whole, the country has hitherto got on astonishingly well.

III.—THE DISTURBING FORCES.

8. The proximate cause which tends to disturb the equilibrium is the tendency to extend cultivation, which reduces the area available for grazing both in developed country and in the less developed areas where cattle are largely bred. As I have indicated above, the disturbance so produced in the equilibrium between food and cattle in developed country tends to be adjusted fairly rapidly through the action of the individual cultivator; but the tendency to disturb the equilibrium in supply of cattle is in all probability not so quickly counteracted.

9. The extension of cultivation is itself the result of various tendencies, the chief of which may be the increased pressure of population, a rise in the standard of living and the development of trade which follows on improved communications. It would be rash to hazard an estimate of the present pressure of population as compared with that last recorded: plague, famine and fever have left their mark on recent years: but I should be surprised if a census taken now should indicate

a material increase in the population of late years. The second cause, a rise in the standard of living, is, I believe, of great importance in the sense that the amount of chronic under-feeding grows slowly less; while the effect of the development of trade is too obvious to be discussed.

10. It is, however, unnecessary for the present argument to analyze in detail the causes that lead to extended cultivation. The broad fact remains that what the province needs is a larger income, and that this is obtained by extended cultivation. There is no doubt that many people are still under-fed: so far as consumption of food is increasing it is matter for unmixed satisfaction, and so far as raw produce is exported it is matter for satisfaction tempered only by regret that the produce is not worked up in the country. But it must not be forgotten that a surplus produce of food in ordinary years is a most important matter from the point of view of famine administration: so long as the cultivator bears the vicissitudes of the grain market, it is much better that he should have some produce stored in advance than that at the onset of scarcity he should come into the market as a buyer; and if the small normal food surplus is to be maintained while consumption increases, an extension of cultivation is almost inevitable pending a change in agricultural methods, or in the alternative the production of raw material must be correspondingly reduced. These considerations appear to me to go far to justify the ordinary official view that an extension of cultivation is in itself a thing to be desired; and so far as it can be shown that the extension is coincident with an improved standard of living the doctrine is not open to serious dispute.

11. I hold, then, that the extension of cultivation is a matter for reasonable satisfaction. Even if it were not, I do not see how Government could interfere with any permanent effect. The land under government control is relatively insignificant; and any legislation in restriction of cultivation

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could be carried out only with the support of the bulk of the landholders; support which can hardly be counted on. And apart from this aspect, the operation seems to me to be too dangerous and delicate for Government to attempt. It would be in effect an insurance scheme requiring the abandonment of a certain amount of income, either present or shortly to accrue in order to avoid some future loss; there are no data for working out the equation that is involved: and if there were it would be impossible to secure anything like distributive justice in the scheme—in other words, to ensure that the ultimate gain should accrue to those who bear the immediate loss. It would be poor comfort to a landholder in Kheri to say that by reserving his land for grazing a time would come when cultivators in Bara Banki would get cattle cheaper than if he now put it under cultivation.

IV.—The compensating reactions.

12. But it appears to me that this extension of cultivation, satisfactory in itself and not preventible by government action is bound to give rise to tendencies in the opposite direction. One of these has been already mentioned—the adaptation of the course of cropping to the needs of the cattle. When land formerly used by cultivators for grazing comes under the plough, it yields in any case a fair share of fodder as secondary product*; and apart from this, the cultivators who formerly depended on the grazing will grow crops that yield more fodder so as to make up the deficiency. It is true that in some cases, such as the substitution of millet for cotton, this would be unsatisfactory; but the more probable adaptation is an extension of wheat-growing: while where canal water is available and holdings are sufficiently large the

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* Note.—If it is put under large millets and spring cereals it may yield more fodder than before while yielding food as well. The enormous value of the large millets is not uncommonly overlooked.

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adaptation will be effected by growing crops exclusively for fodder, a distinct advance in practice.*

13. A second tendency which comes automatically into operation is the more speedy elimination of inefficient cattle. So long as there is ample grazing, these live on till carried off by disease or old age: but as grazing becomes restricted they are crowded out by the more vigorous animals and die off sooner.

14. So far as regards the adaptation of food to cattle. As regards the adaptation of production to requirements, it seems to me to be indisputable that the extension of cultivation must disturb the relative values of cattle and farm produce, cattle becoming more, and produce less, valuable as the demand for cattle increases and the supply falls off. It has been asserted that this change in relative values is in progress: I think this is probably true; but the question cannot be effectively discussed while prices are rising all round; there is no "standard" bullock, the price of which can be tabulated as against the price of wheat, and the prices quoted for "ordinary plough cattle" are of no use for comparative purposes, since the "ordinary" standard is itself liable to change with prices. In any case it seems to me to be certain that a rise in the relative value of cattle must follow the extension of cultivation, and that this must induce one or both of two counteracting tendencies, which may be spoken of as extension of village breeding and of professional breeding.

15. It is well known that, even where plough cattle are usually imported, every cultivator who can manage it keeps some sort of a cow for the sake of the milk. Now when the cost of plough cattle becomes inconveniently high relatively to the income of the farm, it is certain that the cultivator will place more value on his calves than he does at present. They will be regarded as more important and more attention will be given to their rearing. It is possible, too, that in some

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* NOTE.—The growth of fodder crops is sometimes spoken of as negligible, but in the autumn of 1906 nearly one-fifth of the area in the whole of the Meerut division was returned as under fodder crops.

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places increased attention will be given to the choice of a bull, and on the whole I think it probable that more, and better, animals will be reared in the villages.

16. I do not myself think this change will result in more than a slight reaction against the higher cost. It is very difficult to say beforehand, and village breeding may become much more important than I think; but I feel myself that any considerable extension of the existing practice would involve the provision of enclosed meadows or crofts for cows and calves. Such a development is not impossible in some parts of the country: the enclosed mango groves of parts of south Oudh, which are now kept mainly for a reserve of grass, could easily serve the purpose, while in the larger holdings in the west of the province the necessary land could probably be spared. But I do not myself expect that the development will occur on a large scale until new forces shall act with sufficient strength to increase materially the size of holdings. The adaptation is more likely to come in the form of extended professional breeding, a process which implies that land now coming under cultivation will ultimately go back to grazing until the equilibrium in values is restored.

17. The idea of cultivated land going back to grazing will appear so unfamiliar at first that it is advisable to explain the mechanism of the process. Leaving out of account the upland barren lands * (*usar*) as not likely to be of much use either for cultivation or for grazing, all the land of the province may be regarded as arranged in a series according to its suitability for cultivation relatively to grazing, suitability being determined by situation as well as other natural qualities. Thus the market gardens round Lucknow (to take a conspicuous example) stand at the head of the series because they are so suitable for cultivation that their value for grazing could not be greater in any conceivable circumstances. At the other

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* Note.—The question of their utilization for grazing or fodder supply has been studied most exhaustively by the agricultural department, and the results are almost entirely negative.

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end of the series stand such lands as the hillsides of Bundelkhand or the Jumna ravines, where cultivation is so nearly out of the question that their maintenance for grazing seems assured. And between these two extremes lies the rest of the land of the province, which could be used either for cultivation or for grazing, and which will in the long run tend to be used for whichever purpose promises the larger profit. At present the tendency is for cultivation to oust grazing; but this tendency is certain to be reversed when the change in relative values become sufficiently pronounced.

18. That this interchangeability is a fact is shown clearly by the recent history of the riverside lowlands, which are in process of transfer from grazing to cultivation, but which have in the past gone from cultivation to grazing. It is shown, too, by the history of parts of Bundelkhand, where cultivation has given place to grazing as the more profitable industry; and it is not possible to deny that (for any given position of relative values of crops and stock) there is some land which is "on the margin of grazing," that is to say which will pay as well under grazing as under cultivation. The margin shifts with every change in relative values, and—assuming ordinary mobility—the equilibrium between the supply of cattle and the cultivated area (which measures the demand for cattle) will tend to be restored after each disturbance. The conclusion must be that the tendencies at work will ultimately secure a supply of cattle adequate to the needs of the country, and that Government is concerned not to regulate these tendencies (which, indeed, it cannot do), but to give them the freest scope, and to minimize the economic friction which is likely to delay the ultimate adjustment.

19. To many this conclusion will appear obvious but I have thought it best, even at the risk of being tedious, to state the argument at length, mainly for the reason that every

consideration which I have advanced has been overlooked from time to time in the discussions of the last twenty-five years. I proceed to consider the question of practical interest —the action that can be taken to accelerate adjustment.

V.—MAXIMS OF GOVERNMENT ACTION.

20. Starting, then, with the fundamental principle that it should be the object of Government to facilitate the operation of the tendencies leading to equilibrium I would suggest that a programme of action may be based on the following derivative maxims:—

(i) care must be taken that nothing of permanent value is lost during the period of transition;

(ii) the assured grazing grounds should be developed so as to support the greatest possible number of cattle:

(iii) all possible facilities should be given for village breeding;

(iv) any assistance that is required should be offered to professional breeders to maintain or extend their operations;

(v) the interest and support of the landholding classes should be enlisted in the attempt to accelerate adjustment.

I proceed to state the measures which, in my opinion, may be attempted under each of these heads.

VI.—SECURITY AGAINST PERMANENT LOSS.

21. It is obvious that while the forces at work favour the extension of cultivation, there is risk that a valuable breed may cease to exist or may seriously deteriorate, and that specialized skill and knowledge may be lost as breeders take to some other occupation; these I class as permanent losses.

22. As regards breeds, we have so far as is known no breeds of special value except those of the Kheri district, which

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will in my judgement be adequately provided for by the measures recommended by Mr. Fremantle and Mr. Oliver in their report on the subject: the doubtful point is whether adequate grazing grounds can be secured in the way proposed, but this can be ascertained only by experience. With the exception of these special breeds the cattle of the provinces can only be described with our present knowledge as *desi*, that is as the result of a long period of haphazard mating. There may be other breeds worthy of special attention, and if so they will be found in the course of the cattle survey which the veterinary officers are conducting in the scanty time which alone can be afforded at present, but as yet no such breeds are known.*

23. The other risk, that of losing specialized skill and knowledge, requires somewhat more detailed consideration. I cannot estimate the extent to which, or the localities where, the loss is likely to occur because I have not the necessary detailed knowlege, and I do not believe this knowledge is at present available. The professional breeders are, so far as I know, mostly small men: their names are not recorded for taxation or for statistical purposes, nor do they come into touch with the local revenue administration. I have usually found them reticent about their operations, and they shun contact with officials, a fact which is explained in part by the reputed association of cattle theft and cattle breeding. It appears to me that if the administration is to interest itself in the affairs of these men, it must get into closer touch with them so as to know when and where their occupation is threatened and devise means to tide over the period of transition.

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* NOTE—Much has been written about the Kenwaria breed of the Banda district; but it appears fairly certain that (if it is a distinct breed at all) its home lies not in the Banda district but in the states lying further south, and other breeds which have been mentioned from time to time have proved equally elusive.

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24. As a beginning I recommend a survey of the breeding industry, as distinct from the survey of cattle now in progress. I would begin this at the large cattle fairs ascertaining in detail the sources of supply to each, and would then examine these sources in detail to ascertain imminent dangers and possible remedies. The preliminary study would require special qualifications, and I would not entrust it to either the district authorities or the veterinary department. One or two tahsildars chosen for their efficiency and tact should be placed on special duty for long enough to enable them to make a round of the principal fairs and collect the preliminary data: the subsequent study of the needs of the various breeding areas could then probably be carried out by the district staff.

25. It would be premature to forecast the action that might be required as the result of these inquiries since they are designed to collect information which is not now available. I should, however, expect the inquiries to disclose localities where grazing is getting scarce, and it would then be the Collector's duty to endeavour to secure the reservation of sufficient land in each threatened area to ensure the maintenance of the industry. The means of doing this would naturally vary with the circumstances, and no general line of action can be laid down in advance.

VII.—DEVELOPMENT OF ASSURED GRAZING GROUNDS.

26. The second maxim I have suggested enjoins the development of the assured grazing grounds. I would limit the term assured grazing lands to (i) government land including forests, (ii) the Bundelkhand hillsides, (iii) the ravines. I have already excluded from consideration the upland barren lands (*usar*), and I would not treat the lowlands (*khadir*) as assured to grazing, in their entirety since it would not require a very large development of engineering practice to render large areas

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of the lowlands exceptionally fit for high grade cropping.

27. The forests, and the government estates in the Tarai, may be a valuable asset as the administration has a free hand subject to existing engagement—the growth of trees in the first case, and the interests of settled tenants in the second. But the Tarai at least has the great drawback that rinderpest (and perhaps this is true of other diseases) is endemic, and while the existing industry should be encouraged I would not myself advise measures designed to secure a rapid extension until disease has been brought more effectively under control. I am not at present prepared with suggestions for action on government land: the survey of the industry which I have suggested would disclose any serious drawbacks that may exist, and action could then be taken to remove them or to mitigate their effects. It must, however, be recognized that, to a certain extent and in certain circumstances, the interests of forestry may be opposed to those of breeding, and the adjustment of these conflicting interests will have to be in the nature of a compromise.

28. For the Bundelkhand hillsides, too, I have at present no suggestions; in this case, again, a survey of the industry might be expected to indicate some lines of action, though I am inclined to think not very much can be done beyond steady persistence in the present policy of holding up water as high as possible all over the country. This policy will doubtless lead to extension of cultivation in the level lands benefited by storage, but it seems to me very probable that this reduction in the grazing area will be much more than made good by the improvement of the grazing on slopes too steep for cultivation.

29. As regards the third class of assured grazing land, the ravine systems of the plains, the obvious policy is to find remunerative methods of improving the grazing, and then to educate the landholders to adopt these methods. This matter

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has been before me for some time and a note drawn up in consultation with officers of the Public Works department is being circulated separately.

VIII.—ASSISTANCE TO VILLAGE BREEDING.

30. I turn now to the third of the maxims which I have laid down—enjoining the grant of facilities for village breeding. The points to consider here are (1) land and (2) bulls.

31. As regards land, the awakening of landholders to the importance of the subject (discussed below) will not improbably result in the preservation of some common grazing grounds which might otherwise come under the plough; but, as I have said above, it appears to me that any considerable extension of village breeding involves the provision of enclosed crofts for young stock. As I have said, I am doubtful whether this development is at all probable, but it is worth while to bring it to the notice of landholders as a possibility and to ascertain what forms of assistance might be expected to encourage it. The provision of land for village breeding must, however, depend mainly on the success obtained in arousing the interest of the landholders.

32. The question of supplying bulls for village breeding is very complex. I have on a previous occasion suggested that when a village or group of villages contains a sufficient number of cows of a distinct and suitable breed Government might provide a bull of the same breed to be maintained by the village. I adhere to this suggestion, but it is at present of little practical importance as we do not know as yet of any such villages. A possible development in the same direction is to stimulate landholders to the provision of such herds by the offer of a bull. There are various difficulties here—breeders will not part with good cows: cattle are so closely adapted to their environment that to start a herd in a new locality is a highly speculative operation; we have only the Kheri breeds

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available in the provinces, and their range is limited. Such an offer might be made, but its results would be very local and by no means certain; and it seems to me that for a long time to come the bulk of the provinces will have to be content with their present mongrel cows, and that it should be a definite interest of Government to see that the supply of bulls to serve these cows is maintained and if possible matured. The cows are, it is true, of a low grade both as milkers and as parents of working stock: but they are in their way very useful and there is no substitute immediately available.

33. Now there is a long course of experience in these provinces to confirm the view supported by the theory of breeding that to put a pure bred bull (Hissar, Khairigarh or what not) to serve a mixed lot of cows is far too uncertain a measure to justify its adoption by Government. The result of such mating is a few good calves, a few no better than their mothers, a few practically worthless and a considerable proportion of failures. The worthless and the failures are remembered, the good are forgotten and the bull gets a bad name which he shares with the Government that supplied him at considerable expense. On the whole, it is likely that better results will be obtained by village bulls for the cows of mixed breed.

34. The experience gained in placing out selected bulls of the local type in parts of Bundelkhand has been most unsatisfactory, and the defects that were found in the system appear likely to reproduce themselves elsewhere. A bull kept at stud costs a great deal to feed; persons who agree to manage one soon get tired of the expense and the trouble, and the bull gets out of condition and loses repute. Again, bulls kept in confinement are apparently less satisfactory in this part of the country than if allowed to run with the cows; but a man who undertakes to manage a bull usually wants to get a share of the expense from the owners of cows and prefers that the cows should be brought to the bull. I do not think

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therefore that the general need can be met by placing out village bulls in charge of private managers: the cost, too, would be very great.

35. Government management of village bulls is out of the question; there is no suitable local agency, and the expense of maintaining a special staff would be prohibitive. It has been suggested that the difficulty of management could be met by handing the bulls over to co-operative societies of cowowners, who would thus share the expense of maintenance. There are parts of the country where this development ought to succeed, but personally I feel that it would be unwise to press it forward until the principle of co-operation is more firmly established among the people: successful societies of cultivators will no doubt maintain a bull in addition to their other activities, but I do not recommend an attempt to organise societies for this specific purpose.

36. We are thus brought by a process of exhaustion to consider whether anything can be done to maintain and develop the existing system of supply, the practice of dedicating bulls and leaving them free from all control. This is essentially a question for the people themselves, and can best be dealt with in the conference which I propose.

37. It will be noticed that I have not included the supply of fodder among the methods of assisting village breeding. The people can settle this for themselves and I think they will do so, but I need not say that the study of the subject will continue in the agricultural department. My own opinion is that the systematic extension of irrigation is the most important thing, and this is already the settled policy of Government.

IX.—ASSISTANCE TO PROFESSIONAL BREEDERS.

38. There is not much to be said at the present stage regarding the fourth maxim—enjoining assistance to professional breeders—for the reason that our knowledge of the subject is still too imperfect to justify suggestions. The

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survey of the industry which I have suggested in order to find out where it is threatened will at the same time show what assistance it needs. My impression is that localities will be found (as has already happened in north Oudh) where measures are wanted to preserve land from cultivation; and I think it will often be possible to do this, at least in the lowlands held under short settlements, by negotiation with the landholders, assisted by moderate variation in the assessment according to the purpose to which the land is put. Such negotiations will be greatly facilitated if the interest of landholders generally can be aroused in the whole question, as I propose should be attempted. It is, however, premature to discuss this question in the absence of definite information regarding the localities where land is wanted.

39. Another question that may come up is the supply of cheap capital for breeders. The industry requires a relatively large amount of capital, and it is some time before returns begin to come in; it is also somewhat speculative, and my information (which on this point is very slight) suggests that interest is exceptionally high. If then enquiries disclose localities where an extension of breeding is possible, an offer of capital on reasonable terms might be expected to facilitate extension. The offer cannot be made under the Land Improvement Act (XIX of 1883) except for the special purpose of improving grazing land, while loans under Act XII of 1884, which can be made for any purpose "connected with agricultural objects," are restricted to owners and occupiers of arable land, an expression which would not always include cattle breeders. It might be worth while to propose an amendment of the Act so as to meet the case in the event of its occurring.

X.—ENLISTMENT OF LANDHOLDERS' SUPPORT.

40. Lastly comes the question of arousing the interest of the landolders to the importance of the whole matter. In my opinion this is perhaps the most immediate need, for the tendencies which it is desired to accelerate must operate through

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the action of individual landholders, and it is here that inertia and economic friction are likely to cause the greatest delay in the ultimate adjustment of supply. I believe it is safe to say that at the present time the extension of cultivation is the ideal of most improving landholders, and that this is the case even when the rents to be secured are very low; and the object should be to get landholders to consider, for each proposed extension, and also for areas where actual cultivation yields little profit, whether it would not be for the benefit of the estate as a whole to devote the land to cattle breeding instead of to cultivation. In other words, it is desirable that landholders should consider the position of such of their land as lies on or near the "margin of grazing," and decide on the way of using it with due regard to all the circumstances, instead of regarding all culturable land as destined for cultivation—the common attitude at the present time.

41. Recent experience suggests that a conference is very much the most effective method of arousing public attention in this part of India, and it seems to me that the time is ripe for a conference of selected landholders representing all the divisions of the province, who should be asked to discuss most of the questions dealt with in this note, more particularly the provision of land for breeders and the assistance of village breeding by provision of both land and bulls. At such a conference Government could define its attitude on the whole question, the educative effect on the landholders could hardly fail to be of great value, and at the same time their practical experience would probably rule out some of my suggestions as of no practical use and would almost certainly bring forward new suggestions worthy of detailed consideration.

XI.—SUMMARY.

42. To sum up. The suggestions which I put forward for hastening the adjustment of equilibrium in the supply of cattle may be enumerated as follows:—

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Cattle-supply and grazing land.

(1) Preservation of the Kheri breeds on the lines already approved, and the adoption of similar measures where they may be shown to be required for the preservation of other breeds of value.

(2) A survey of the breeding industry to localise the dangers, followed by action to avert these dangers as far as possible, and to facilitate extension and improvement.

(3) Demonstration of methods of improving ravine lands.

(4) Favourable treatment of enclosed grazing crofts by the Revenue and Irrigation departments.

(5) Acquisition of power to make advances of capital for cattle breeding.

(6) Discussion of the whole subject by a conference of representative landholders.

W. H. MORELAND,

Director of Land Records and Agriculture, United Provinces, on special duty.

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DISTRICT NOTE.

DEHRA DUN.

THE district comprises two sub-divisions, which differ so much as to call for separate description.

JAUNSAR BAWAR.

Topography.

THIS is a mountain and forest tract with but little cultivation. Agricultural statistics are not prepared for it, but cultivation has not extended materially in the last forty years and there is believed to be practically no room for expansion. The villages grow barely sufficient food for their inhabitants, and importation is required in unfavourable seasons. In addition to the food-grains, a small area in each village is sown with a valuable crop for the market: potatoes, turmeric and chillies are the crops usually grown for this purpose, but cultivation of the opium-poppy is permitted in villages which are unsuited to the other staples. Sheep are largely reared for food. Irrigation is carried out from streams and springs wherever the surface of the ground permits water to be carried.

Annals.

The early records regarding this tract are meagre. In 1896-7 the crops failed owing to drought, particularly in the southern villages. Distress supervened, and difficulties were experienced in devising suitable methods of relief. Relief-works were found to be impracticable except a little path-making near the villages; and as a rule all that could be done was to give advances to the people to enable them to buy food.

The rains of 1900 were favourable and the crops good, but cattle disease was prevalent. The rains of 1901 were

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unsatisfactory and the kharif crops were poor: while deficient rain in the winter caused considerable injury to the rabi. From 1902 to 1906 the seasons were on the whole favourable, apart from local injury due to hailstorms, locusts and some unidentified insects. In 1907 heavy rain and hail in April damaged the rabi, while the following kharif suffered serious injury owing to the failure of the rains at the end of August. The drought continued till the end of the year, and the rabi of 1908 was again poor. Relief measures were required from February to August 1908: small works were opened, but the total numbers requiring relief did not at any time exceed 1,000.

The rains of 1908 were unevenly distributed and were deficient in September, the southern villages suffering most. The spring of 1909 was marked by drought and the rabi was poor. The rains were however good and the kharif gave a normal outturn. The spring of 1910 was again dry and the rabi suffered seriously. In this year the rains were favourable and a good kharif was secured while the rabi crops of 1911 were excellent.

Progress.

The condition of the tract appears to be stationary: there have been no marked developments, and no adverse changes in the period under review.

Dangers and possible remedies.

The prosperity of the tract is a question of rainfall. The chief danger appears to be premature cessation of the rains: a dry September involves the loss of much of the kharif and also endangers the rabi. A dry spring is also a serious menace to the rabi, which usually requires showers as late as March to ensure a full yield. On recent experience the south of the tract appears to be more exposed to these risks than the north. No remedial operations can be suggested: but the tract should be recognised as one where the pressure of the revenue requires special attention in unfavourable seasons.

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Dehra Dun.

TAHSIL DEHRA.

Topography.

The tahsil includes a mountainous tract on the north and north-east and below this the Dun. Cultivation in the mountainous tract is carried on wherever the slopes are not too steep: the permanent fields are elaborately terraced, and are irrigated where possible from streams or springs. This area was demarcated as the Hill circle in the settlement of 1907.

The Dun is the valley between the Himalayas and Siwaliks, closed on the east by the Ganges and on the west by the Jumna. It is a deep depression filled with detritus from the mountains and with a layer of soil of very varying thickness superimposed. The land is divided into two parganas which practically coincide with the drainage areas: the Eastern Dun is drained by the Song and Suswa rivers flowing into the Ganges, and the Western Dun by the Asan flowing into the Jumna. These rivers flow near the line of the Siwaliks and nearly all the land to the south of them is forest.

The Western Dun has comparatively small areas of forest north of the Asan. It was divided for assessment purposes into the river-tract and the submontane tract together with the plateau on which the town of Dehra Dun is situated. The land is cut into sloping plateaux by the deep torrent-beds running from the Himalayas to the Asan. The lowlands are usually good rice-lands, but the upper portions are dry and stony. The Dehra plateau is more fertile; and there is another fertile area along the Jumna.

The Eastern Dun is still mainly forest: its soil is more fertile than that of the Western Dun, but the climate is very unhealthy. The richest villages are those which adjoin the town of Dehra Dun: the rest of the settled country is distributed among the blocks of forest.

Water-supply.

The formation of the Dun—a layer of soil on a deep substratum of boulders—makes irrigation important for profitable rabi cultivation, and the same formation makes well-sinking impracticable for irrigation purposes. Water is obtained from the various streams and springs by five Government canals, and a large number of small private channels. The common defect of these is that the sources yield least water when the seasons makes the need most urgent: the Katapathar canal on the west is taken from the Jumna, but the other sources depend on the rainfall of the immediate locality. In addition, the private channels are liable to failure through their head works being damaged by floods.

Cattle-supply.

The number of cattle in the Dun is large, but the quality is usually inferior, and efforts to improve it are reported to have been unsuccessful. The best cattle are imported from the upper doab. Rinderpest is very common in the Dun; protective inoculation is now welcomed by the people. Other forms of cattle-disease have not occurred recently.

Annals.

The early reports do not disclose any untoward features in this tract. There was no distress in the famine of 1896-7 and the rabi area in that year did not show a serious fall. In 1901 the rains ceased early, and the kharif crops suffered from drought and also from locusts. The rabi of 1902 was very poor owing to continued drought, but the following kharif was satisfactory. The years 1903 and 1904 were prosperous. In 1905 wheat was affected by rust, but the loss was not very serious. The next event reported was the premature cessation of the rains in 1907 when half the kharif crops were lost and the rabi of 1908 was contracted. There was slight distress in the hill and submontane circles from April 1908, but it disappeared with the kharif crop which was fairly good.

The rabi of 1909 was affected first by drought, and then by excessive rain in April and was a poor crop. The kharif

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was successful, but in 1910 the rabi in the hills and submontane tracts again suffered from drought. There was in this year the promise of a very fine kharif crop, but it was somewhat injured by heavy rain in October, and yielded slightly less than the normal. The rabi of 1911 was good.

Progress.

The cropped area shows a substantial advance in recent years. This has occurred mainly in the Eastern Dun since the opening of the railway in 1900, which gave access to areas very badly provided with communications. The swamps in this tract have almost disappeared, and the climate has improved, but it is still the chief obstacle to further expansion.

There is on the whole a slight improvement in the class of cropping. Tea has not extended of late years and is not now very profitable : there has been no expansion of the area under sugarcane, the growth of which is hampered by want of sufficient water and by the ravages of wild animals; while fruit-growing, for which the Dun is apparently well-suited, has made little progress. On the other hand there is a substantial increase in the areas under wheat and fine rice, the principal market crops of the district, and the area under oats is expanding. The pulse known as *tor*, an early-ripening form of *arhar*, which is of much importance as a rotational crop, has been affected during the last decade by wilt-disease, and its area fell seriously in 1910, but there have been no complaints of the disease for the last two years, and apparently recovery has set in.

The irrigated area has increased with the expansion of cultivation. The settlement officer found that the Government canals were inadequate to supply the areas which they nominally commanded, but many improvements have since been carried out.

The population shows continued increase, the rise in the last decade exceeding that recorded in 1901. Wages have

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risen substantially in the last five years, and the prevailing rate for unskilled labour in 1911 was 4 annas a day.

Government loans for land improvement are practically unknown, and agricultural loans appear to be taken only in adverse seasons and then as a rule to a small extent. There has been no development of agricultural co-operation.

The railway from Hardwar to Dehra Dun which was opened in 1900 has been of very great benefit: besides giving access to portions of the Eastern Dun it has facilitated the export of fine rice and forest produce and the import of coarse food-grains and general merchandise. Apart from the railway, communications have not been materially improved in recent years, and the Eastern Dun requires in particular more bridges to put it in touch with the railway.

The rents of recorded occupancy tenants have given an average rate of Rs. 3·1 per acre in the three years that have elapsed since the completion of the settlement: rents of other tenants give a rate of Rs. 7·1 per acre. The figures cannot be compared with those for the period before settlement when grain-rents were not distinguished, but apparently competition rents have risen rapidly during the last decade.

Local industries are of importance, especially limestone-quarrying and the collection and utilisation of forest produce. Among organised industries brewing has been established for some time, and three small mills producing rice, flour and oil have recently been established. A glass-factory was opened some years ago but recently went into liquidation. The long-continued attempts to establish a silk-industry were eventually abandoned, but it is not certain that the failure was conclusive.

The sums distributed in the district by money-orders are considerable, but apparently belong to the towns rather than the agricultural tracts. The district derives a large source of income from visitors to Dehra Dun and Mussooree, the needs of the latter town providing employment for large numbers of coolies from the hills.

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Dehra Dun.

Dangers and possible remedies or improvements.

1. The first month of the kharif season should include enough fine weather for tillage, and continuous rain at this period is likely to result in a contraction of the area soon. The second month should be much wetter, and a prolonged break in it will reduce the area under late rice and also injure the early crop.

The rains should be prolonged through September though with less frequent falls to ensure the success of the late rice, which suffers seriously if this month is dry.

2. The rabi area depends mainly on the rainfall of September and may fall seriously if this month is dry. The success of the crop depends partly on the supply of water in the canals and partly on the winter rains: short and moderate falls are beneficial up to March, while a dry spring is most injurious in the hill tracts. Hail in the latter part of the season may have serious results.

3. Serious injury from insect-pests has not been reported in either season. Rust has appeared on wheat in a wet spring, but has not been known to cause very serious loss. The assistance of the Agricultural department should be promptly obtained if the wilt-disease on *tor* reappears, or if smut is reported on oats, or the potato-moth on potatoes.

4. There is no experience of conditions likely to produce distress in the Dun proper. The hill-tract is likely to require a certain amount of relief if a bad kharif is followed by a dry spring. No conditions are known in which a fodder-famine must be expected.

5. No suggestions can be made for the improvement of the water-supply beyond a continuance of the present policy of the Irrigation department for the developement of the canal system.

6. It is possible that with the extension of cultivation in the Eastern Dun questions of drainage may become important; the swamps that have now almost disappeared may

reappear and extend and this will probably mean an increase of sickness; but at present there is no indication that works are needed.

7. To minimise losses from cattle disease, it is important to insist on prompt reporting of outbreaks, and to maintain a sufficient veterinary staff to localise outbreaks when they occur.

8. There is apparently little scope for the *takavi*-system in ordinary seasons, but loans should be made available in unfavourable seasons, and to replace working-cattle that have died of disease.

9. The agriculture of the Dun is in some respects peculiar, and its improvement might be made the subject of special study by the Agricultural department when opportunity offers. Taking a general view there appears to be room for a considerable development of orchards and market-gardens to serve the adjacent markets of the plains.

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DISTRICT NOTE.

SAHARANPUR.

Topography.

THE natural features of the district are somewhat diversified but the surface can be divided into five fairly distinct tracts, the Siwalik, the *ghar*, the Jumna *khadir*, the Ganges-Solani *khadir*, and the central upland.

The Siwalik tract includes the range of hills of that name, running on the north-east of the district. This tract is reserved forest.

Below the Siwaliks is the submontane tract known as the *ghar*, which corresponds to the formation elsewhere described as Bhabar and Tarai. It consists mainly of a sloping substratum of boulders and gravel, on top of which is a shallow layer of soil; the surface is deeply scarred with the torrent-beds which bring down the drainage of the hills. The value of the soil varies principally with its depth. Water even for domestic purposes is difficult to obtain in this tract. Along the foot of the slopes is a belt of swampy country where the water absorbed by the boulders comes to the surface, and near which originate the various streams that go to make up the minor rivers of the south of the district. This tract is widest at the north-west, where it includes the greater part of pargana Fyzabad: it includes also the north of Muzaffarabad, Bhagwanpur, Roorkee and Jwalapur: in Bhagwanpur and Roorkee considerable portions of it are occupied by reserved forest.

The Jumna *khadir* is not at first well-defined in pargana Fyzabad, but the high cliff marking its limits is plain from the south of this pargana through Sultanpur, Sarsava, Nakur

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and Gangoh: the *khadir* is widest at the north and narrows southwards, but widens again in the south of Gangoh. Ordinarily there is fertile clay under the bank and along the lines of depression, and elsewhere light and and fairly productive soil merging into sandy wastes near the river: but in the south of Gangoh there is much less-productive clay. The northern portion is as a rule fully cultivated, but much culturable land remains untilled in the south.

On the east of the district a large area is enclosed between the Solani and the Ganges, and here the *ghar* tract passes without interruption into the *khadir*, which includes most of parganas Jwalapur and Roorkee, the centre of Bhagwanpur and the east of Manglaur. The character of this *khadir* varies greatly, the soil ranging from ridges of sand to stiff clay in the swamps. It is a very backward tract, thinly populated and inadequately tilled, with large areas of inferior jungle.

The rest of the district forms the central upland, which comprises the whole of tahsil Deoband, most of tahsil Saharanpur and the east of Nakur with the south-west of Roorkee. The bulk of this consists of a fertile loam, passing into inferior sand along the streams and into clay in the depressions. The soil is on the whole lighter to the east than to the west of the Hindan, which flows down the centre of the tract, and—like the other minor streams—has small areas of lowland which are liable to injury from flood.

Water-supply.

There is practically no irrigation in the *ghar*. The surface is unfit for canal irrigation, and the deep substratum of boulders makes well-sinking impossible.

In the *khadirs* irrigation is as a rule little required. There is some canal-irrigation in Jwalapur, and elsewhere temporary wells can usually be made if the need arises.

The upland tract depends mainly on canals. On the west of the Hindan the Eastern Jumna canal serves parganas Saharanpur and Rampur, where comparatively few wells are used, and also tahsil Nakur, in which however wells are also largely employed. On the east of the Hindan the Ganges canal with the Deoband branch supplies the west of Manglaur, Deoband and part of Nagal. Between these two systems, there is an extensive tract comprising most of Haraura and parts of Bhagwanpur and Nagal where only wells are available.

The uplands are as a rule not adapted to well-sinking: foundation-clay is absent over large areas, and where it is found it is often at an excessive depth. Temporary wells can be made in places, but are expensive; and most of the existing masonry wells are (like the temporary wells) supplied by percolation, and yield only a small quantity of water. Very little hostility has been recorded on the part of landholders, but the cultivators as a rule are not anxious to put money into wells; there is however scope for construction in those localities (recorded in detail in the well-survey) where at present the water-supply is inadequate and where foundation-clay exists.

Drainage.

The drainage of the uplands is generally adequate, and the natural channels have been both improved and supplemented by the Irrigation department. Of late years there have been no complaints of widespread injury from over-saturation, but small areas still from time to time require treatment.

Cattle-supply.

There is no professional cattle-breeding in the district and in the south the stock of cows is not great; but in the north and east there are considerable numbers, which depend on the forests and jungles for grazing. The young stock is largely sold to dealers who take it south and east. The amount of breeding is strictly limited by the quantity of grazing that is available. Suitable bulls are not available in

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sufficient numbers: they should be obtained from North Oudh or Rohilkhand, and not from the west. The better class working cattle are imported partly from the Punjab and partly from North Oudh.

The district is liable to suffer from all the common forms of cattle-disease. The practice of preventive inoculation is now welcomed by the people.

Annals.

The early reports disclose very few injurious tendencies in operation. The droughts of 1896 and 1899 led to a substantial reduction in the rabi area in the *ghar* and to those parts of the uplands which have not canal-irrigation, but in neither year was there any distress. In 1901 the *ghar* tract suffered from drought: and investigation carried out under the orders of the Commissioner led to the conclusion that the only possible improvement was the construction of tanks to hold water for the cattle, but no action in this direction appears to have been taken, and it appears doubtful from the nature of the country whether suitable sites for tanks can be found in many villages.

The seasonal yields from 1903 onwards are given in the following table:—

Year.	Rabi.				Kharif.				
	All crops.	Wheat.	Barley.	Gram.	All crops.	Rice.	Maize.	Cotton.	Sugar cane.
1903 ...	85	88	88	75	89	87	87	50	94
1904 ...	87	94	94	87	87	94	87	94	87
1905 ...	89	94	94	87	60	62	69	75	63
1906 ...	92	94	94	87	98	115	81	87	94
1907 ...	80	81	81	81	56	62	56	75	75
1908 ...	65	69	69	47	87	87	81	87	87
1909 ...	81	81	75	81	92	94	94	87	87
1910 ...	90	94	94	81	79	81	75	81	87
1911 ...	86	87	94	81					

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Saharanpur.

There were no winter rains in 1903, and the monsoon rains were late: heavy falls late in the season led to floods in the Jumna *khadir* and seriously injured the cotton crop. The year 1904 was uneventful; and the frost of 1905 did no material damage. In this year the rains were late and the kharif area was reduced; while all crops suffered from drought throughout the season. The year 1906 was prosperous. In 1907 the rabi suffered somewhat from excessive rain late in the season; while the kharif was greatly injured by drought, the monsoon rains being very late and ceasing in August. The rabi area of 1908 was consequently reduced, and the crops suffered from want of moisture aggravated by strong west winds. During these seasons revenue was suspended, and advances were liberally given, but no direct relief measures were required.

The rains of 1908 were on the whole favourable but left the ground too dry for a full rabi area for 1909, and the value of this crop was reduced by rain at the end of the season.

The kharif of 1909 and the rabi of 1910 were satisfactory; but the kharif of 1910 was affected by the irregularity of the rains which were scanty at first and excessive at the close of the season. The heavy falls gave a very large rabi area for 1911; this crop was exceptionally promising but suffered from rain in March and April.

Progress.

The area under crops shows little change in the last two decades: there was at first some shrinkage in the *khadir* tracts but this has been made good, and there has been a slight extension in the Ganges *khadir*. The proportion of remunerative crops has risen substantially and is now high: the rise is due to the steady expansion of the area under wheat; cotton is stationary and sugarcane has if anything declined. No new staples of value have been introduced. Fruit-growing has made considerable progress, especially near Saharanpur city, and the export trade is of some importance.

The last ten years have seen a slight advance in the practice of sowing the kharif early with canal-irrigation. Little maize is as yet sown in this way, but about three per cent. of the cotton and fodder-crops are sown as against barely one per cent. at the earlier period.

The canal-system has not been materially extended during the period under review, but much improvement has been effected by extension of drainage channels.

Well-construction was somewhat accelerated by the droughts of 1905 and 1907 but the impetus is apparently spent. In 1911 there was one masonry well to 141 acres of normal cultivation as against 155 acres in 1905. On the whole irrigation facilities have not been increased, but individual villages have been benefited by small improvements.

The population of the district increased slightly between 1891 and 1901, but there has been a marked fall in the past decade and the population is now somewhat less than in 1891. The rates of wages of unskilled labour have risen in the last five years, and vary in rural tracts from 10 to 14 pice. The rise in the towns is more marked.

In ordinary seasons *takavi*-advances are practically never taken. Excluding the year 1907-8, when about two lakhs were advanced, mainly for temporary purposes, no advances have been taken since 1902-3. Only one small co-operative society exists in the district, where a regular propaganda has not yet been undertaken

The construction of the Shahdara-Saharanpur Light Railway has greatly facilitated communications in the south-west of the district. Additional stations have been opened on the railways previously in existence, and there is now a station to 107 square miles as against 204 square miles in 1891. There has been no appreciable extension of metalled roads, and recent reports describe the unmetalled roads as still very bad; communication is difficult in the *ghar* tract and the *khadirs.*

There has been no regular enhancement of the rents of recorded occupancy tenants during the last two decades: the earliest figures available, those for 1894-5 give an average rate of Rs. 4·1 per acre; by 1904-5 the rate had increased to Rs. 4-4-0, and this figure was maintained until 1910-11. Competition rents have moved more rapidly: the rate in 1894-5 was Rs. 5-1-0; in 1904-5 it was Rs. 6-1-0, and in 1910-11 it had reached Rs. 7-0-0, the rise in the last few years being particularly marked.

The indigeous textile industries have declined under competition but are still of some importance; those based on forest produce, such as wicker work, have probably somewhat extended. Organised industry is now represented by a ginning and pressing mill, and by some small rice, flour and oil mills; the milling of flour appears to be extending somewhat rapidly. The railway shops at Saharanpur and the various workshops at Roorkee also afford considerable employment and provide the district with an unusually good supply of skilled workmen.

The district derives a substantial income from external sources: the sums distributed annually by money-orders have risen in ten years from about twelve to nearly eighteen lakhs. The sources of this income are not clearly known: part of it comes from the fruit-trade, and it is believed that a considerable portion represents the earnings of skilled workmen employed in other districts.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the

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area will fall, though the loss may be to some extent made good by larger sowings of rice, and also of *bajra*, which can be sown until nearly the end of August. If the rains are delayed, sowings can be made with irrigation in a large proportion of the central upland.

The area under late rice is determined largely by the weather of the second month, when frequent falls of rain with little sunshine are desirable. A long break at this period must be expected to reduce the area substantially.

The area planted with sugarcane is influenced by the weather in early spring, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains.

2. The yield of the early dry crops, of which maize is much the most important, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains to the middle of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they may give very little grain if September is altogether dry.

The late rice requires more rain in September than is suitable for the dry crops, and (if canal water is not available)

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at least one fall in October is desirable for its complete success.

The distribution of the food-crops is on the whole such as to secure a reasonable supply in seasons of different types.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. Apart from variations in the rainfall, floods in the *khadirs* appear to constitute the chief danger to the kharif. Serious injury from insect-pests has not been reported, but should be watched for, especially in the case of cotton and sugarcane.

4. The rabi area depends mainly on the rainfall of September and early October: good rain in the later month secures an area largely in excess of the normal: if September is altogether dry the rabi is likely to fall seriously except in the areas protected by canals, where *paleo*-irrigation is practised on a large scale.

5. In ordinary seasons, the rabi in the canal-areas is not dependent on winter rains, but outside the central upland moderate falls between December and February are of great importance. Falls late in March or early in April will probably do some harm, while prolonged periods of damp and cloudy weather must be expected to produce rust on wheat and linseed, and the loss from this cause may be serious.

When the ground has been dry at sowing-time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frosts occurring in January are not likely to cause serious injury to the staple crops. A frost in the middle of February or later might do great harm, but the contingency is most unlikely. A January frost may injure the vitality of the seed-canes, and thus affect both area and yield of the next sugarcane crop.

Hailstorms are not important until the cereals are earing, but the danger from them increases as the season advances.

The rapeseed crop may be much injured by the aphis if damp and cloudy weather occurs while the plants are in flower.

7. The area sown with *zaid* crops in ordinary seasons is very small, and it does not increase greatly when stocks of food are low.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout a large part of the district, but its effects will be most noticeable in the *khadirs*, where the cultivated area is likely to fall and the collection of the revenue will need careful attention.

9. Judging by past experience it appears to be improbable that direct measures of famine-relief will be required in the district, but some action will be necessary when the rains have ceased at the beginning of September. In 1907-8 the

following action was taken :—

Revenue suspended,	kharif	Rs.	67,000
„ „	rabi	„	40,000
Revenue remitted,	kharif	„	12,000
„ „	rabi	„	20,000
Improvement loans			½ lakh
Advances for rabi			1¾ „

10. The occurrence of a fodder-famine appears to be a most unlikely contingency, and no conditions (short of an entire failure of the rains) can be indicated as likely to produce it. In seasons when the rains cease early, *juar* fodder occasionally becomes poisonous, and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods : the only action possible is to provide advances if required to enable cultivators to replace cattle that have died from this cause.

11. There is not much scope for a large improvement of the water-supply. Loans should be made available for cultivators who wish to sink wells, but well-sinking should not be pressed on the people generally. Should a practical form of percolation-well be devised, arrangements should be made for the construction of a sufficient number to serve as demonstrations.

The question of providing a domestic water-supply for the *ghar* tract might be carried further by a local investigation to see if storage-tanks are possible.

12. No important drainage operations are known to be required, but probably wet seasons will disclose the need for minor improvements in the system.

13. To minimise losses from cattle-disease, attention is needed to enforcing the prompt reporting of outbreaks on the system prescribed in the Land Records Manual ; and the veterinary staff should be sufficient to localise outbreaks when they occur.

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Saharanpur.

Action should be taken (*a*) for the preservation of the grazing-grounds in the north of the district, and (*b*) for the supply of bulls, on any lines that may be authorised by Government.

14. The supply of agricultural capital appears to be fairly sufficient in ordinary years, and there is little scope for the *takavi*-system unless a demand should arise for loans to sink wells. Agricultural loans may however be required in unfavourable seasons, and when September has been dry they should be given on a fairly large scale: they may also be desirable after a serious outbreak of cattle-disease, to enable cultivators to replace working-cattle without delay.

15. There is at present no agency for the introduction of agricultural improvements requiring associated action. It is possible that the need may be met by the growth of a co-operative organisation designed primarily to secure objects other than the supply of credit.

The cropping of the district requires to be examined before definite suggestions can be made for its improvement, but there is probably room for better cotton and better sugar-cane in some localities.

More effective tillage-implements would be an improvement, especially in the *khadirs*, and these need not be the cheapest of their class.

The development of the fruit-industry should continue to receive attention, particularly in the matters of packing, transport and marketing: the question of packing is of special importance in view of the large potential production of peaches and other soft fruit.

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DISTRICT NOTE.

MUZAFFARNAGAR.

Topography.

THE district lies in the upper duab, and is divided by natural features into five principal tracts running roughly parallel to the rivers.

The Ganges *khadir* is extensive in the north where it includes the whole of pargana Gordhanpur and a portion of Bhukarheri bounded by the Solani river: it narrows in this pargana and then widens again in Sambhalhera. The northern portion is exceedingly precarious: it is affected by seepage from the uplands and by floods on the Solani, and contains large swamps and uncultivated areas. The southern portion is less swampy but is exposed to damage from floods.

West of the *khadir*, from which it is separated by a high cliff with ravines, is the Ganges canal tract, which extends to the west Kali nadi and includes parganas Purchhapar, Khatauli, Jansath, most of Muzaffarnagar, and the west of Bhukarheri and Sambhalhera. This tract is marked by the amount of sand: there are extensive sand-ridges in the north and a plain of sand broken by ridges in the south. The western fringe of the tract is broken land leading to the *khadir* of the west Kali nadi. Most of the drainage collects towards the south to form the source of the river known in Meerut and further south as the Kali nadi, but here spoken of as the East Kali or Nagan.

The central tract comprises the land between the west Kali and the Hindan, the two rivers uniting on the southern border of the district. There is broken ground and narrow strips of lowland along the rivers on each side: most

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of the land is a plateau marked by a smaller proportion of sand than is found to the eastward. This tract comprises the eastern portions of parganas Charthawal, Baghra, Shikarpur and Budhana and a small area on the west of Muzaffarnagar.

West of the Hindan lies the Eastern Jumna tract, taking its name from the canal which passes through it. The Kirsani river flows through the centre on its course to join the Hindan; and it is bounded on the west by the line of the Jumna *khadir* which is marked approximately by the course of the Katha nadi. This tract includes the west of parganas Charthawal, Baghra, Shikarpur and Budhana, the whole of Kandhla, Thana Bhawan, Shamli and Jhanjhana, and the east of Kairana. The land in the north is naturally inferior and is badly cultivated: it improves southwards and the southern portion is described as perhaps the best in the district.

The Jumna *khadir* includes the whole pargana of Bidauli and the west of Kairana. It is not swampy, but it suffers both from floods and from sudden changes in the course of the river.

Water-supply.

There are practically no sources of irrigation other than canals and wells. Wells are relatively unimportant in the Ganges canal tract, where the canal enables a sufficient, though not a full, rabi area to be sown in years of severe drought. The northern portion of the central tract is supplied by the Deoband branch canal, and here too wells are little used. They become of more importance towards the south in Shikarpur and Budhana, and here the rabi area tends to fall more seriously when irrigation is required before sowing. The Eastern Jumna tract is watered by the canal of that name, but a substantial amount of irrigation from wells is also carried out: the canal is almost fully worked in ordinary seasons, and the additional water required in drought comes mainly from the wells.

Construction of masonry wells is hindered in many places where they would be useful by the absence of foundation-clay, the distribution of which is very irregular; the facts ascertained regarding it are recorded in the well-survey. There appears to be little hostility to construction on the part of landholders, but financial assistance is required in a substantial number of villages in tahsil Kairana, and a few elsewhere. Temporary wells are little used: the localities where they can prove of service in drought are recorded in the well-survey.

Complaints regarding defective drainage in the Ganges canal tract were at one time very numerous, but a large number of drainage cuts have been completed, and the danger of over-saturation has been mitigated if not entirely removed. The central tract has a much better natural drainage system and only small additions have been required. In the Eastern Jumna tract considerable waterlogging resulted from the canal works, but the drainage system had practically been completed twenty years ago, and there have been no recent complaints of its insufficiency.

Cattle-supply.

The number of cows kept in the district is proportionately considerably higher than in the districts to the south. The difference is not marked in the upland tracts, where there is little grazing-land, and the number kept along the Jumna *khadir* is relatively low as the inhabitants prefer to keep buffaloes. The cows in this tract approximate to the Punjab type, and many are covered by Punjab bulls. The chief stocks of cows are kept in the Ganges *khadir* where there are a few large herds, and many small ones. These cows differ from those near the Jumna and are more nearly allied to the submontane breeds; there is a want of good

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breeding-bulls, which should be met from North Oudh or Rohilkhand, and not from the Punjab.

The *khadirs* are more or less self-supporting, and young stock from the Ganges *khadir* are sold to Rohilkhand; they are little used in the upland tracts, which prefer to buy working cattle from the Punjab or from the Batesar fair. Such cattle are taken round the village by dealers of the district, who at the same time buy up young local stock for sale in Rohilkhand.

The district is liable to all the common forms of cattle disease. The practice of preventive inoculation is now welcomed by the people.

Annals.

The reports of the district up to 1895 dealt almost exclusively with floods and waterlogging. Both the *khadirs* were at that time much depressed: a special cause affecting the Ganges *khadir* was the clearance of the population in 1894, in anticipation of a serious flood expected to result from the bursting of the Gohna dam in Garhwal. The flood did not take place, but the cultivators who had been removed from their homes were not anxious to return. In the uplands too, particularly in the Ganges canal tract, losses by flood were serious, particularly in 1894, and drainage-works were undertaken.

The drought of 1896 led to a serious contraction in the rabi area of 1897, but there was no anxiety regarding distress. In 1899 again, the early cessation of the rains reduced the rabi area, but the reduction was made good in the following year; and in 1901 it was noticed that both the *khadir* tracts showed marked improvement. In Gordhanpur in the Ganges *khadir* the cultivated area had risen from about 8,000 to 15,000 acres, and in Bidauli in the Jumna *khadir* from about 15,000 to 20,000 acres; the rise has on the whole been maintained up to 1911. In 1912, the rains ceased early, and the lighter soils in the uplands had a poor rabi, while sugarcane was damaged by hoppers.

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The seasonal yields from 1903 onward are given in the following table :—

Year.		Rabi.				Kharif.			
		All crops.	Wheat.	Barley.	Gram.	All crops.	Rice.	Maize.	Sugarcane.
1903	..	89	94	94	81	87	87	87	87
1904	...	94	94	87	94	87	87	87	81
1905	...	92	94	94	94	66	60	75	70
1906	...	92	94	94	87	93	90	94	109
1907	...	87	87	87	84	31	22	25	75
1908	...	62	69	62	50	87	87	87	88
1909	...	87	87	87	87	91	87	94	96
1910	...	94	97	97	87	76	56	81	87
1911	...	100	100	97	100	...	...	...	...

In 1903, the rains only began on 20th July, and the kharif area was reduced, but the yield was fairly satisfactory. The year 1904 was prosperous. The rains of 1905 were again late, and were deficient almost throughout the season; the kharif yield was poor, but both crops of 1906 were good, although the *khadirs* suffered from floods. The rabi of 1907 was somewhat affected by excessive damp but the loss was not serious.

The rainy season of 1907 lasted only from 25th July to the end of August. A full kharif area was sown but the yield was very poor. Irrigation was necessary before the rabi of 1908 could be sown and the area was much below the normal. The dryness of the land made the west winds of March more injurious than usual and the yield was poor. During these seasons there was no sign of distress, and no direct measures of relief were required.

The rains of 1908 were at first heavy, and the *khadir* were flooded, but they were somewhat deficient in September. Sowings for the rabi of 1909 were hindered by the dryness of the ground and the prevalence of malaria, and the yield was somewhat affected by drought. The following rains were favourable, and a full rabi area was sown for 1910. The rains of this year were at first very light and later heavy. Sowings were restricted: the *khadirs* were flooded, rice suffered from the early drought, and other crops from excessive falls at the end of September. The late rain however enabled a very large rabi area to be sown for 1911, and this crop was quite successful.

Progress.

The area under crops has risen substantially in the last two decades: the rise is proportionately greatest in the *khadirs*, but is shared by most parganas in the upland tracts. There is probably little or no room for further expansion under existing conditions. The proportion of land sown with remunerative crops is the highest in the province, and shows a tendency to increase. The indigo crop was even twenty years ago of little importance, and its decline has not produced serious results. The main staples, wheat and sugarcane, are more largely grown, and the cotton area is fully maintained.

The practice of sowing the kharif crop early with canal irrigation shows substantial advance in the last decade. The proportion of maize so sown has not altered but that of cotton has increased and fodder is now sown early on a much larger scale. Taken together, about eight per cent. of these crops was sown with irrigation in 1910 as against about four per cent. at the earlier period.

There has not been any great increase in irrigation facilities, which twenty years ago were exceptionally great. Only minor improvements in the canal-system have been carried out, and well-construction has not proceeded rapidly, the number increasing by about 100 annually of late years. There is now one masonry well to 86 acres of normal cultivation. The drainage-system in the Ganges canal tract has

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been substantially improved, but it has not been fully tested in recent years.

The population rose very rapidly between 1891 to 1901 but most of the increase has been lost in the last decade, owing mainly it is understood to the prevalence of plague, and in 1911 the numbers were 808,000 as against 773,000 in 1891.

Rates of wages have risen somewhat sharply in the last five years and in 1911 ranged between 2½ and 4 annas, the latter rate being quite common.

Small sums are advanced in ordinary years for land improvements, chiefly masonry wells. The amount taken for this purpose in 1907-8 was only Rs. 22,000, a figure which indicates the minor position occupied by well-irrigation. Temporary agricultural loans are taken to small amounts in ordinary seasons. There has been no development of agricultural co-operation; and, as is the case in Meerut, capital is much more easily obtained in the villages than in most parts of the province.

The chief improvement in communications has been the opening of the Shahdara-Saharanpur light railway which traverses the Eastern Jumna tract from north to south. A few additional stations have also been opened on the North-Western Railway, so that there is now one station to 128 square miles, as against 414 square miles in 1891. There has been no important addition during this period to the mileage of metalled roads, and a considerable number of feeder-roads are required to facilitate the movement of produce to the railways.

There has been no general enhancement of occupancy rents in the last two decades; the recorded figures for 1894-5, the earliest year available, give an average rate of Rs. 4·4 per acre and in 1910-11 the corresponding figure is Rs. 4·6. Competition rents show a steady rise; the average rate was Rs. 6·6 in 1894-5, Rs. 7·8 in 1904-5 and Rs. 8·6 in 1910-11.

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Local industries are of little importance and consist chiefly of cotton-weaving and blanket-making, both of which have suffered from competition. *Gur* is made from the sugar-cane, and sugar refining is relatively unimportant. No industry organised on modern lines exists in the district.

The district does not apparently draw a large income from external sources. The sums distributed annually by money-order have risen from about six to about eight lakhs during the last decade, and a substantial proportion of the rise is known to represent revenue money-orders.

Dangers and possible remedies or improvements.

The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of rice, and also of *bajra*, which can be sown until nearly the end of August.

The small area under late rice requires frequent falls of rain in the second month, and a long break at this period involves a reduction in the area.

The area planted with sugarcane is influenced to a small extent by the weather in the early spring at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

The area sown with cotton is affected to some extent by the nature of the sowing seasons; an early start and a dry season are favourable. The chief factors determining the area are the profits obtained in recent seasons, and the relative prices of cotton and food-grains.

2. The yield of the early dry crops, of which maize is much the most important, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains to about the middle of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The late rice requires more rain in September than is suitable for the dry crops, and (where canal-water is not available) at least one fall in October is desirable for its complete success.

The distribution of the food-crops is such as to secure a supply of food in all types of moderately unfavourable seasons.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

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3. Apart from variations in the rainfall, floods in the *khadirs* constitute the principal danger to the kharif crops. Serious injury by insect-pests has not been reported, but it should be watched for, specially in the case of sugarcane and cotton. In one season the former crop was reported to have been attacked by grass-hoppers: it is not known if these insects were identical with the cane-hopper which has recently caused so much loss in the eastern districts, but if similar damage is reported it should be referred without delay to the agricultural department.

4. The rabi area extends substantially above the normal when rain falls in early October: it declines when September is dry, but irrigation facilities are so great that a substantial area can be sown in the worst seasons. In the *khadirs* the area may be reduced by late floods, which may leave the land unfit for sowing.

5. In ordinary seasons the bulk of the rabi crops can be matured by irrigation without winter rains: these however are beneficial up to about the end of February, provided the falls are moderate in amount and of short duration. Rain late in March or early in April will probably cause some injury, while prolonged periods of damp and cloudy weather between January and March are likely to be followed by rust on wheat. The injury from this cause may be serious, and its extent may not be fully realised till the crop is harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frosts occurring in January are not likely to cause serious injury to the staple crops, but they may affect the vitality of seed-canes and thus reduce both the area and the yield of the next sugarcane crop. A frost occurring in the middle of February or later would probably be a most serious calamity, but the contingency is very unlikely.

Hailstorms occurring before the cereals are coming into ear are not likely to be important, but the danger increases as the season advances.

The rapeseed crop may suffer severely from the aphis if damp and cloudy weather occurs while the plants are in flower.

7. The area sown with *zaid* crops in ordinary seasons is of little importance, and it does not increase materially when stocks of food have been reduced.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts, but this is not known to have occurred.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen almost throughout the district, but its effects will be most noticeable in the *khadirs*, where the cultivated area is likely to fall and the collection of the revenue will require special attention. The Ganges canal tract will also require watching in such seasons in case the provision for drainage may still be inadequate.

9. The necessity for direct measures of famine-relief has not arisen in recent years, and the conditions in which it may arise cannot be stated, but the contingency is apparently remote. Indirect relief is however likely to be required when

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the rains have ceased at the beginning of September. The following action was taken in 1907-8.

Revenue suspended, kharif	... 1 lakh.
" " rabi	... 1¼ "
Revenue remitted kharif	... Rs. 13,000
" " rabi	... nil.
Improvement loans	... ¼ lakh.
Advances for rabi	... ⅓ "
Advances for kharif	... ½ "

10. A fodder-famine appears to be a most unlikely contingency, and the conditions in which it might be expected cannot be stated. In very dry seasons *juar* occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances if required to enable cultivators to replace cattle that have died from this cause.

11. Few recommendations can be made for the improvement of the water-supply. Loans should continue to be given when required for masonry-wells, and a boring staff maintained to assist in locating sites; while if a practicable form of percolation-well is devised arrangements should be made for the construction of a sufficient number to serve as demonstrations. There may be scope for the employment of power-pumps on some of the minor rivers.

12. There is at present no demand for drainage works, but the areas in the Ganges canal tract which have suffered from saturation in the past should be watched when wet seasons recur.

13. To minimise losses from cattle-disease, attention should be given to enforcing the prompt reporting of outbreaks under the rules prescribed in the Land Records Manual, and a sufficient veterinary staff should be maintained to localise outbreaks when they occur.

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Any action that may be authorised by Government should be taken (*a*) to preserve the grazing grounds in the Ganges *khadir*, (*b*) to improve the supply of bulls in the same area.

14. The district is relatively well supplied with agricultural capital, and the scope for the *takavi*-system in ordinary years is practically limited to occasional loans for well-sinking. Agricutural loans may however be wanted in drought both for the rabi and the next kharif, and also possibly in the spring for planting sugarcane: and they should be offered in localities that have suffered from cattle-disease to ensure prompt replacement of working-cattle.

15. There is at present no effective agency for the introduction of agricultural improvements requiring associated action, but it is probable that the Jat community could be organised for this purpose.

The cropping of the district requires examination before definite suggestions can be made for its improvement, but probably there is room for better varieties of cotton (when available), and (in some localities) of sugarcane. Improved tillage implements—not of the cheapest types—are likely to be adopted, and the less expensive forms of labour-saving machinery. The district is specially fitted for extending the consumption of oil cakes as fodder in the event of a development of the oil-industry.

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DISTRICT NOTE.

MEERUT.

Topography.

THE district lies between the Ganges and the Jumna and is divided into five principal tracts lying roughly parallel to these rivers. The assessment circles framed at the recent settlement, while not absolutely topographical, are so nearly so that the extent of the various tracts can be indicated with substantial accuracy.

1. *Ganges* khadir.—The *khadir* is widest at the north (about 6½ miles) and gradually narrows towards the south where the river flows close under the high bank: in parganas Garhmuktesar and Puth there are only a few alluvial mahals, but in Hastinapur and Kithor there is a tract between the high bank and the alluvial mahals most of which is settled for the full term, and which forms the fourth (or *khadir*) assessment circle in these parganas: here there is an old bed of the river, known as Burhganga, now forming a swamp close under the uplands; between it and the Ganges the land is, apart from the wandering channels, fairly high and is not exposed to particular danger from floods or waterlogging; the soils, however, are mostly poor and light, and the kharif area exceeds that of the rabi.

2. *Eastern uplands.*—This tract lies between the high bank of the Ganges and a line running a little to the west of the Hapur-Saharanpur road: the assessment circles included in it are shown on the margin: the tract includes about one-third of the villages and 38 per cent. of the cultivated area of the district.

Pargana.		Assessment circles.
Hastinapur	...	I, II and III.
Kithor	...	I, II and III.
Garhmuktesar	...	I, II and III.
Puth ...	...	I, II and III.
Sarawa	...	All.
Hapur	...	All.
Meerut	...	III and IV.

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Along the Ganges there is a border of wild, uncultivated ravines: inland the country is a succession of sandy slopes with intervening levels of better soils not so good however as in the west of the district. The worst portions are the IV and V circles of pargana Hapur.

On the west there are several streams which eventually unite to form the Kali nadi: their courses have been improved to secure better drainage than formerly existed. A line of *jhils* runs southwards from Kithor into Bulandshahr where it eventually develops into the Nim nadi: this drainage line has been improved by the Irrigation department and is now effective.

3. *Central depression.*—This tract lies between the eastern uplands and (roughly speaking) the course of the main Ganges canal: it is made up of the assessment circles shown on the margin, and include about one-eight of the villages and 11 per cent. of the cultivated area of the district. There are, it is true, a few high-lying villages in Dasna, but practically the whole pargana comes into this tract. The tract lies rather low, the soil is heavy and *reh* is found in places. It is naturally liable to over-saturation in wet years: the drainage has been greatly improved, but it is impossible to be certain that all villages have been protected, and the tract should be watched when wet seasons recur.

Pargana.		Assessment circles.
Sardhana	...	III.
Meerut	...	Central.
Jalalabad	...	I and II (Lowlying).
Dasna	...	All.

4. *North-west tract.*—This tract extends from the western edge of the central depression as far as the Jumna, except towards the south where a stretch of *khadir* intervenes: it is made up of the assessment circles shown on the margin, and includes over one-third of the villages and 48 per cent. of the cultivation of the district. The Hindan flows through it, having a moderate-sized *khadir* which is liable

I.—Circles along the Hindan,

Pargana.		Assessment. circles.
Sardhana	...	II.
Barnawa	...	III.
Meerut	...	II.
Jalalabad	...	III.
Loni ...	...	II.

II.—Circles away from the Hindan.

Sardhana	...	I.
Barnawa	...	I and II.
Meerut	...	I.
Jalalabad	...	I and II.
Loni	...	I.
Baraut	...	All.
Kotana	...	All.
Chhaprauli	...	All.
Baghpat	...	I*a*, I*b*, II*a*, II*b*.

to over-saturation and extension of *reh*. The villages affected by this river have usually been grouped in separate circles which are shown in the table given above. The slopes from the river to the high land, both on the Hindan and on the Jumna, are poor for a short distance; the rest of the tract consists of extraordinarily rich and uniform soil, fully irrigated and splendidly cultivated. There is a depression down the centre of Baghpat, most of the villages affected by which are classed in circle Ib of that pargana, but its drainage has been improved and is now apparently adequate. In the past the only real drawback of this tract was the want of adequate communications west of the Hindan, but the construction of the light railway from Shahdara to Saharanpur has removed this defect.

5. *The Jumna* khadir.—There is scarcely any *khadir* until pargana Loni is reached on the south, where the Hindan approaches the Jumna. Here there are two types of *khadir*: the upper, which is protected from floods, and the lower, which is not protected. Both alike consist of poor soil with few and bad cultivators. The upper *khadir* includes assessment circle III in Baghpat and Loni (28 villages in all) and the lower *khadir* consists of circle IV (39 villages) in Loni.

Water-supply.

There are practically no sources of irrigation other than canals and wells. The canal-system is extensive and this is one of the few districts where canal largely exceeds well-irrigation. The eastern uplands are traversed by the Anupshahr branch, but have on the whole much less canal irrigation than the area to the west; parganas Hapur and Sarawa in particular are badly served. The central depression and the land westwards to the Hindan are supplied by the main Ganges canal; while the land west of the Hindan has the Eastern Jumna canal.

wanting: these are relatively most extensive in parganas Hapur, Sarawa and Kithor. Masonry wells are popular with cultivators, but there is some hostility to their construction on the part of landholders: such hostility has been recorded to exist in 113 villages. There is still considerable scope for assisting the construction of additional masonry wells. Temporary wells are possible over considerable areas.

Judging by the experience of 1907, large portions of the district can with proper assistance sow an adequate rabi area in seasons of extreme drought. Sarawa and to a less extent Hapur are weak in the eastern tract, while Barnawa is markedly inferior to the rest of the north-west tract, and Loni naturally secures only a small area.

Cattle-supply.

The proportionate number of cows is higher than in the districts to the south, but is below the provincial average, and except in the Ganges *khadir* there is no organised breeding industry. The Jumna *khadir* is mainly devoted to buffaloes, while the uplands have no grazing areas and the people prefer to import working stock ready for use. Considerable numbers of *desi* cows, including a few herds of 100 head or more, are kept along the Ganges bank and grazed in the *khadir*. These herds supply the local needs, but very few of the stock go to the uplands, where cultivators prefer animals from the Punjab: surplus young stock are sold to Rohilkhand. There is some need of good bulls in this area; they should be of one of the Rohilkhand strains, not of the western breeds.

The upland cultivators are for the most part supplied by itinerant dealers, who obtain their stock at the Punjab fairs and also at Batesar. The district is liable to all the common forms of cattle-disease. The practice of preventive inoculation is now welcomed by the people

The district as a whole has been prosperous since the em of annual reports was introduced. During the wet ons ending in 1894 particular tracts were found to suffer floods or waterlogging, but each was taken up in turn he Irrigation department and the drainage improved. *khadirs*, too, had largely gone out of cultivation. In the years that followed the district prospered : the drought of 6 was little felt and the canals enabled the people to profit he misfortunes of the rest of the country; even the dry ges appear to have got through the year without difficulty, no relief measures were required.

There was heavy rain in 1900 but no extensive damage flood was reported, while the report of this year notices ease in *reh* and increase in cultivation in the Ganges dan and Jumna *khadirs*. There was rust on wheat in 1901 the damage was nowhere serious. In 1902 the winter s were deficient, but the loss to the rabi was much less ous than had been expected, and the next year was favour-.

The seasonal yields from 1903 onwards are given in the wing table :—

ear.	Rabi.				Kharif.				
	All crops.	Wheat.	Barley.	Gram.	All crops.	Juar.	Maize.	Cotton.	Sugar cane.
03 ...	85	88	85	88	90	100	94	62	81
04 ...	94	94	94	94	94	87	87	100	87
05 ...	88	87	94	100	60	62	62	75	62
06 ...	71	75	80	62	100	100	100	94	100
07 ...	100	100	100	100	44	25	62	50	80
08 ...	69	69	75	44	90	94	81	94	100
09 ...	84	81	87	87	97	87	100	100	100
10 ...	112	113	113	113	81	81	75	62	100
11 ...	113	106	125	119	...	...	...	...	...

rain and by high winds in March. The kharif was generally fair but cotton was much injured by rain in October. The year 1904 was satisfactory, and the rabi of 1905 was also satisfactory except that wheat was slightly damaged by the unusual frost. The rains of 1905 began late and were deficient throughout. The kharif was poor, and irrigation was required for rabi sowings. Fodder was scarce during the winter, and the canals were unable to meet all the demands on them. The rabi of 1906, which had been sown on a minimum of moisture, suffered from drought in January, but recovered somewhat when rain fell in February. The two following seasons were favourable, but in 1907 the rains were late and ceased in August. The rabi area of 1908 was very short, and the crops suffered from lack of moisture. The worst tracts were parganas Barnawa, Baghpat, Loni, Hapur and Sarowa. Very large sums were advanced by Government and revenue was suspended and remitted, but no direct relief-measures were required.

The rains of 1908 were at times heavy and the *khadirs* were flooded. The second half of September was dry, and there was a severe outbreak of malaria which interfered with field work: consequently the full rabi area could not be sown for 1909. The crops suffered at first from drought, and later from untimely rain in April. The next four seasons were uniformly favourable except that in 1910 cotton and to a less extent millets suffered from excessive rain at the end of the season, while maize was affected by drought in July.

Progress.

The area under crops shows a slight increase in the last two decades, and is probably near the maximum so that future expansion is unlikely. Fluctuations in area are comparatively slight except in an altogether exceptional season such as 1907-8.

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The proportion of money-bringing crops is very high, and is if anything increasing. Indigo (which at one time occupied about 13,000 to 15,000 acres) has disappeared, and the wheat area is not expanding, but cotton has increased largely, and sugarcane substantially. On a smaller scale potatoes show a tendency to expand, and oats and lucerne have been introduced in comparatively recent times, while safflower has disappeared.

The practice of sowing certain kharif crops early with canal irrigation has developed considerably in the last decade, especially in the case of cotton and fodder; the development is less in the case of maize. Taking the three crops together, about 16 per cent. of the area was so sown in the 1910, against about 8 per cent. in the earlier period.

There have been numerous minor improvements in the canal-system, but no large supply-channels have been constructed: on the other hand, very great improvement has resulted from the extensive drainage operations which have been carried out. Masonry wells have increased substantially since 1905, under the stimulus of two seasons of drought: there is now one such well to 73 acres of normal cultivation, against 88 acres in 1905.

The population of the district expanded remarkably between 1891 and 1901, but has fallen very slightly in the last decade. Rural wages have risen distinctly in the last five years: in 1911 the rates commonly paid varied from 2¼ to 4 annas, the latter rate being by no means exceptional, while higher rates were found in some villages.

Advances for land improvement were formerly exceptional, but the droughts of 1905 and 1907 have brought a large number of applications for the purpose of well-sinking: in addition to the large sums advanced in 1907-8, advances have since been made to an aggregate of 1¼ lakh. Agricultural loans are taken to a very small extent in normal

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seasons, but a dry year leads to a considerable demand both for cattle and for temporary wells. Agricultural co-operation has made little progress so far: in 1911 there were five rural credit societies with 93 members and about Rs. 4,000 working capital.

Railway facilities have been very greatly increased in the last decade by the construction of (1) the Moradabad Ghaziabad line across the south of the district, with branches from Hapur to Meerut on the north and to Khurja on the south: and (2) the Shahdara-Saharanpur light railway passing through the west of the district. There is now one station to 94 square miles, as against one to 339 square miles in 1891. The district was opened out by metalled roads at an early date, and recent extensions have been limited to completing the roads to Baghpat and Mawana: some feeder roads are still required to serve the recently constructed railway.

The rents recorded for occupancy tenants in 1900-1, the first year of the settlement, gave an average rate of Rs. 5·3 per acre: enhancements just after settlement brought the rate to Rs. 5·5 in 1904-5, and there has been no further rise. Competition rents on the other hand have moved rapidly during the decade: the average rate was Rs. 8·3 in 1900-01, Rs. 9·3 in 1905-6, and Rs. 10·4 in 1910-11.

Local textile industries have declined under competition, and a substantial amount of seasonal employment has been lost by the decline in indigo: the indigenous leather-industry has however expanded rapidly. Organised industries are represented by the soapworks at Meerut and by the ginning and pressing mills recently established at Hapur.

The amount distributed in the district by money-order is at the present time about 20 lakhs annually, having risen from 14 lakhs in the last decade. The sources of this income are not clear, but apparently a large proportion is paid in the cities and towns and comparatively little in the villages.

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Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, though less so than in most districts owing to the extensive facilities for *paleo*-irrigation: but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of *bajra*, which can be sown until nearly the end of August. The area under rice is very small, and its extension in wet seasons will not materially compensate for the reduction in dry crops.

The area planted with sugarcane is slightly influenced by the weather in the early spring, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultitor, which depends mainly on the success or failure of the preceding harvests.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains.

2. The yield of the early dry crops, of which maize is much the most important, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The small area under early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains to about the middle of September; they may be seriously

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injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

A sufficient food-supply is assured in all but the worst seasons, as maize and the late millets ordinarily compensate for each others' losses.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. Apart from variations in the rainfall, the chief danger to the kharif comes from floods in the various *khadirs*. No serious injury from insect-pest has been reported, but it should be watched for, especially in the case of sugarcane, cotton and *juar*.

4. The rabi area depends largely on the rainfall of September and early October: late rain leads to a large extension beyond the normal; moderate drought is little felt in the canal-irrigated tracts, but when September is entirely dry a substantial falling off must be anticipated.

In the *khadirs* the area sown depends to some extent on the period and intensity of the floods: heavy floods late in the season may leave the ground unfit for sowing rabi.

5. In ordinary seasons, when the seed-bed has been sufficiently moist, the rabi crops do not depend largely on winter rains except in the unirrigated areas. Rain is however beneficial up to February provided the falls are moderate in

amount and of short duration. Rain in the latter part of March or early in April is likely to do some harm, while prolonged periods of damp and cloudy weather between January and March must be expected to bring on rust on the wheat; the injury from this cause may be serious, and its extent may not be fully realised till the crop is harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring in January will cause little or no injury to the staple crops, though it is possible that harm may be done just at the end of the month if the crops are forward. There is danger that the seed-canes may be injured at this time, which would mean reduction in area and inferiority of yield of the next sugarcane crop. A frost towards the middle of February might do very serious harm, but the contingency is unlikely.

Hailstorms are not of much importance until the cereals are earing, but the danger from them increases as the season advances.

The rapeseed crop may suffer serious injury from the aphis if damp cloudy weather occurs while the plants are in flower.

Where potatoes are grown a watch should be kept for the potato-moth, which may cause very serious loss (vide provincial note, section VI).

7. The area sown with *zaid* crops in ordinary seasons is not important. It extends, but not largely, when stocks of food are reduced.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts, but this is not known to have occurred in the past.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the *khadirs* of the Ganges, Hindan and Jumna: land will probably go out of cultivation in these tracts, and the collection of the revenue will need careful attention. The central depression will also require watching, in case the drainage should prove inadequate.

9. The district has not recently experienced such distress as to require measures of direct relief, and the contingency appears to be remote. Indirect relief however will probably be needed in seasons when the rains have ceased at the beginning of September. The following action was taken in 1907-8:

Revenue suspended,	kharif	... 2 lakhs.
,, ,,	rabi	... 1⅓ lakh.
Revenue remitted,	kharif	... ⅔ ,,
,, ,,	rabi	... ⅙ ,,
Improvement loans	... ...	... 3½ lakhs.
Advances for rabi	... ...	... 3¼ ,,
Advances for kharif	... ...	... ⅓ lakh.

Small sums were also lent for the purchase of fodder.

10. A general fodder-famine appears to be most unlikely as the water-supply enables fodder-crops to be grown in most unfavourable seasons, but local deficiencies may be felt in non-irrigated tracts when the rains have ceased so early that the millets yield little fodder: these deficiencies can be dealt with by the grant of loans, and it is not likely that importation of grass on a large scale will be required.

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Meerut.

In seasons when the growth of the late crops is stunted *juar* occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances if required to enable cultivators to replace cattle that have died from this cause.

11 Not much remains to be done for the improvement of the water-supply: but loans should be readily given when required for sinking masonry wells, and a boring staff should be maintained to assist in locating sites.

12. There is at present no demand for drainage works, and it is unlikely that even in wet seasons the need for more works (other than very small extensions) will be felt.

13. In order to minimise losses from cattle-disease, attention should be steadily given to ensuring the prompt reporting of outbreaks under the rules laid down in the Land Records Manual; and the local veterinary staff should be sufficient to localise outbreaks when they occur.

Any action that may be authorised by Government should be taken (*a*) for the preservation of the grazing-grounds in the Ganges *khadir*, and (*b*) for the supply of suitable bulls in the same area.

14. The supply of agricultural capital is almost sufficient for the ordinary needs of ordinary seasons, but improvement-loans can still be given with great advantage to secure the construction of masonry-wells. Agricultural loans can advantageously be given on a large scale when the rains have ceased prematurely: the demand will be chiefly for sowing rabi, but some money may be wanted for the following kharif, and there may be a demand in the early spring to enable cultivators to plant sugarcane. Loans may also be desirable in localities that have been affected by cattle-disease, to enable cultivators to replace working-cattle in time for the next tillage-season.

15. There is at present no effective agency for the introduction of agricultural improvements requiring associated action. It is possible that a co-operative organisation may develop with some primary object other than the supply of credit, which would furnish the agency required.

The cropping of the district requires to be examined before definite suggestions can be made for its improvement; there is however a wide field for a superior cotton when available; while the varieties of sugarcane which are specially suited for making *gur* would have to be changed to make sugar manufacture possible. Improved tillage implements—not of the cheapest type—should come gradually into use, especially in the *khadirs*, and there is probably room for a good deal of labour-saving machinery.

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DISTRICT NOTE.

BULANDSHAHR.

Topography.

THE district is roughly quadrilateral, and lies between the Jumna and the Ganges.

The Ganges *khadir* is as a rule narrow and contains little cultivation except at two points, in parganas Ahar and Dibai. The cultivation is fairly stable, that in Dibai being protected by the head works of the Lower Ganges Canal.

The Jumna *khadir* is much more extensive. The chief area is the west of parganas Dankaur and Dadri, with a maximum width of nearly ten miles: but there is also a substantial area in pargana Jewar. Immediately along the river the cultivation is very unstable, while under the high bank of the upland the land is very bad, being clay or swamp and in many places highly alkaline. Between these the land is better, and contains much stable cultivation: it is enriched periodically by the silt of the Hindan river, and depends mainly on the rabi crops. Its quality tends to deteriorate greatly in a series of wet seasons when swamps extend and alkaline efflorescence appears.

Between the two *khadirs* lies the main upland tract, traversed successively by the Patwaha, the Karwan, the Kali nadi and the Nim and Chhoiya streams. The soil is usually light and inferior near the rivers, there is a well-marked sand ridge east of the Patwaha, and a narrow *khadir* along the Kali nadi, while the level loam is (specially in the south) broken by extensive *usar*-plains, usually alkaline; with these exceptions the plain is substantially uniform, and differences in agricultural value depend mainly on the character of the water-

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supply. The channels of the various rivers, including the Kali nadi, have been improved so that they can carry off the large volume of water brought to them by artificial drainage-cuts, which have been constructed in large numbers.

Water-supply.

The *khadirs* are not as a rule irrigated, but temporary wells are usually possible in them. The land between the Patwaha and Karwan is irrigated by the Mat branch and that between the Karwan and Kali nadi by the main Ganges canal, while the tract between the Chhoiya and the Ganges is served by the Anupshahr branch. The land between the Kali nadi and the Chhoiya is without canal irrigation. This tract includes the greater part of Bulandshahr tahsil, the west of Anupshahr and a small portion of Khurja.

Masonry wells are numerous and are very popular with the cultivators, but in a few villages in almost all parganas the landholders are hostile to their construction; this hostility is most common in parganas Jewar and Dibai. In most parts of the uplands there is little difficulty in making wells as foundation-clay is general and has a good supply below it. The Bulandshahr tahsil is in this respect inferior: foundation-clay is missing in several villages of Agauta and Baran, and in nearly half the villages of Shikarpur, and experience has shown that in seasons of drought the last-named pargana is unable to sow the same proportion of rabi as the parganas which have canal-irrigation. Temporary wells are used to some extent in the southern parganas, especially Dibai, but they are not generally popular, and in many places they are impracticable. There are practically no other sources of irrigation than canals and wells.

Cattle-supply.

The number of cows in the district is small, buffaloes being preferred for dairy-purposes, and there are few breeding bulls. Cultivators in the uplands usually buy their cattle when ready for work and prefer animals brought by dealers

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from the Punjab, while the local young stock are sold to Rohilkhand. The uplands have exceptionally little grazing land, and the Jumna *khadir*, where a breeding-industry might be possible, is devoted mainly to buffaloes. Villages along the Ganges, especially in Ahar and Dibai, have a moderate supply of cows, and the young stock is taken into work locally; these villages have at present an inadequate supply of bulls.

The district is liable to all the common forms of cattle-disease. The practice of preventive inoculation is now welcomed by the people.

Annals.

The earlier reports do not contain much information of importance. Up to 1894 complaints were numerous of defects in the drainage of the uplands, but the drainage system was steadily improved, and in later years the subject became much less prominent. By 1895 the Jumna *khadir* was found to be seriously deteriorated by the extension of swamps and alkali, and the revenue was temporarily reduced. The district did not suffer from the drought of 1896, when practically a full rabi area was sown. In 1899, on the other hand, the early cessation of the rains led to a substantial fall in the rabi area, especially in the tract between the Kali and the Chhoiya. About this time the question was examined of introducing canal-irrigation into Shikarpur, the worst pargana; but the scheme was abandoned as the Irrigation department considered the formation of subsoil and position of water-level to be such that an extensive spread of alkali would probably result.

In 1902 the rabi crops suffered from drought, rain having ceased at the end of the previous August, and there were complaints of inadquate supplies in the canal. In this year the rains were excessive in the early part of the season, and maize and cotton were affected injuriously. The seasonal yields from 1903 are given in the following table :—

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Bulandshahr.

Year.	Rabi.				Kharif.				
	All crops.	Wheat.	Barley.	Gram	All crops.	Maize.	Juar.	Cotton.	Sugarcane.
1903 ...	84	88	88	81	84	81	87	81	94
1904 ...	86	87	87	81	87	81	94	87	87
1905 ...	77	75	87	94	77	87	62	87	85
1906 ...	77	81	87	56	85	94	75	100	100
1907 ...	89	81	94	100	50	62	44	50	75
1908 ...	69	75	75	50	92	100	100	75	87
1909 ...	83	75	87	87	93	87	100	87	100
1910 ...	102	100	106	100	85	97	72	72	106
1911 ...	106	94	119	113	...	...	...	...	...

The rabi of 1903 suffered somewhat from want of winter rains, and the following kharif from excessive moisture. In 1904 the winter rains were too late, while the monsoon rains were irregularly distributed and were unfavourable to maize. About this time the north-east of the district was greatly benefited by improved communications; the Moradabad-Ghaziabad railway had been opened along the northern border of the district, and the railway from Khurja to Hapur was now constructed, while the road from Bulandshahr to Siyana was being metalled gradually.

The district escaped the full effects of the frost of 1905, but wheat was injured somewhat seriously. The rains began late and were exceedingly scanty, and the unirrigated crops were very poor. There was also severe scarcity of fodder in the Jumna *khadir*, and though advances for its purchase were given, large numbers of animals died. The winter rains of 1906 were inadequate for the crops sown on a minimum of moisture, but the monsoon rains of this year were copious; the Jumna *khadir* suffered from floods, and heavy rain with high winds in September was injurious to the millets. In 1907 the winter rains were sufficient and the crops were satisfactory with the exception of wheat, which was affected by rust.

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Bulandshahr.

The rains of 1907 began late, were scanty throughout, and ceased early, so that about half the kharif was lost. The following rabi, the area of which was greatly contracted, suffered from the dryness of the land and the strong westerly winds of March, gram being the crop most affected. During the period of drought, advances were given and revenue was suspended, but no direct relief measures were required. The rains of 1908 were practically confined to July and August: they were at times heavy and the Jumna *khadir* suffered from floods; and their distribution was unfavourable to cotton, but other crops were successful. The dry September, followed by a very severe outbreak of malaria, prevented a full rabi area being sown for 1909; tillage was inferior, and mixed crops were sown in place of wheat. The crops were affected, first by insufficient rain, and then by unseasonable falls at harvest-time.

The rains of 1909 were on the whole favourable, though somewhat too heavy for maize and cotton, and they enabled a full rabi to be sown for 1910. This crop was successful, and the following kharif would have been equally good but for excessive rain in September and October, which injured the cotton and millets. The rabi of 1911 was sown on a very large area, and would have been exceptionally good but for slight injury caused to wheat by rust.

Progress.

Twenty years ago portions of the district were suffering from over-saturation: the progressive improvement of the drainage-system of the uplands has almost entirely removed this defect, and there has been a slight expansion in the area under crops. This movement appears to have reached its limit.

The percentage of remunerative crops has remained constant, but there have been considerable changes in the crops grown. The chief changes have resulted from the disappearance of indigo, which twenty years ago occupied 42,000 acres and had previously been sown even more widely. Its disappearance has checked the expansion of wheat owing to the resulting changes in rotation; it has been largely replaced by cotton, the area under which has nearly doubled. Among other crops, sugarcane, which is grown for *gur*, has extended substantially, and on a smaller scale potato-cultivation is advancing. Safflower, which at one time was locally important, is now little grown.

The most important change in agricultural practice is the development of early kharif sowings with canal-irrigation: more than one-quarter of the area occupied by maize, cotton and fodder crops is now sown in this way.

The sources of irrigation are practically limited to canals and wells. There has been no important development of the canal-system during the last two decades though there have been numerous improvements in detail. The construction of masonry wells has proceeded steadily in recent years, and there is now one well to 57 acres of normal cultivation as against 65 acres in 1905. There appears to be scope for more of these wells in most if not all parts of the upland; but they are most extensively required in parganas Ahar, Agauta, Baran and Shikarpur. The rate of construction is relatively lowest in Shikarpur, where foundation-clay is not uniformly found.

Population increased very rapidly between 1891 and 1901, owing mainly to the improved conditions brought about by the extensive drainage works carried out early in the decade. The increase has not been maintained and the population in 1911 is very slightly less than in 1901: the prevalence of plague is probably the chief factor in this change. Rural wages are rising, though the highest rates are less commonly found than in Meerut.

Of late years the district has taken government loans to a considerable amount for the construction of masonry wells: Rs. 65,000 were advanced in 1907-8 and over Rs. 30,000 in the two following years. Temporary agricultural loans are as a rule taken only in unfavourable seasons. The organisation

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of co-operative credit has made some progress; in 1911 there were 65 rural societies with 3,058 members and 2⅓ lakhs of working capital.

Twenty years ago the communications on the western side of the upland tract were adequately developed, and there were some metalled roads in the south-east, but the north-east was inadequately served. The new railway lines and road already mentioned have materially improved this part of the district, while further south the road has been metalled from Khurja to Chhitari. There is now one railway station to 119 square miles, as against 239 square miles in 1891.

Comparative rental statistics are available since 1904-5. In that year the rents of recorded occupancy tenants gave an average rate of Rs. 4·6 per acre; there has since been a certain amount of enhancement, and by 1910-11 the rate had risen to Rs. 5·1. The competition rent rate in 1894-5 was Rs. 6·6; by 1904-5 this had risen to Rs. 8·1, and by 1910-11 to Rs. 9·1.

The ordinary textile industries have as elsewhere suffered from competition, but the production of goods such as prints and muslins has extended. There is little sugar-refining, as nearly all the produce is sold for consumption as *gur*; while in recent years there has been a large reduction of seasonal employment consequent on the loss of indigo. Organised industries are represented by the numerous ginning and pressing mills which have been established, chiefly in Khurja and Dibai.

The sums distributed in the district by money-order have risen during the last decade from about eight to eleven lakhs; the sources of this income are not clear, but apparently a comparatively small amount comes to agriculturists from outside the district.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting

from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowing of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of *bajra*, which can be sown until nearly the end of August. The area under rice is quite unimportant.

The area planted with sugarcane is slightly influenced by the weather in the early spring, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators which depends mainly on the success or failure of the preceding harvest.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. But sowings are now largely made before the rains, and the chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains.

2. The yield of maize, the only early dry crop that is grown, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month.

The late dry crops require the prolongation of the rains to about the middle of September; they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

A supply of food is assured in all but the worst seasons since maize and the late millets ordinarily compensate each other's losses.

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Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay, the second is the end of the rains: a premature cessation is injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start and suffers from a dry September less than any other crop.

3. Apart from variations in the rainfall, the kharif crops are not known to have suffered serious losses from any cause. Floods occur in the Jumna *khadir*, but it does not depend largely on the kharif. A watch should be kept for the appearance of insect-pests on *juar*, cotton and sugarcane (vide Provincial Note, section VI).

4. The rabi area depends on the rainfall in September and early October, but the facilities for irrigation are so great that even in dry years the fall is serious only in particular areas, notably pargana Shikarpur.

In the Jumna *khadir* the area may fall substantially if late floods should leave the land unfit for tillage.

5. In ordinary seasons, when the seed-bed has been sufficiently moist, the bulk of the rabi crops can be matured without winter rains. These are however beneficial up to February, provided the falls are moderate in amount and of short duration: rain after the beginning of March may do some harm, while prolonged periods of damp and cloudy weather between January and March must be expected to produce rust on wheat. The loss from this cause may be serious, and its extent may not be fully recognised till the crop is harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost before the end of January does little harm except to the *arhar*. The wheat may suffer if it occurs at the end of the month, while a frost towards the middle of February might be a very serious calamity. A severe frost at any time may injure the seed-canes, and thus affect both the area and the yield of the next sugarcane crop.

Hailstorms are unimportant up to the time when the cereals are coming into ear: the danger of injury increases as the season advances.

The rapeseed crop is liable to severe injury from the aphis if damp and cloudy weather occurs while the plants are in flower.

7. The area sown with *zaid* crops is not large in ordinary seasons, and it does not extend greatly when stocks of food are low.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts, but such an occurrence has not been reported in this district.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the Jumna *khadir*, where cultivation will probably decline and the collection of the revenue will require special attention.

9. There is no recent experience of such distress as to require measures of direct relief, and the contingency appears to be very unlikely. Indirect relief is however likely to be wanted when the rains have ceased by the beginning of September: the following measures were taken in 1907-8:—

		Rs.
Revenue suspended,	kharif	31,000
„ „	rabi	46,000
Revenue remitted,	kharif	4,000
„ „	rabi	48,000
Improvement loans		⅔ lakh.
Advances for rabi		½ „
„ „ kharif		⅓ „

A small sum was also advanced to the co-operative organisation.

There are indications in the class of cropping in this and the following season that advances could have been given with advantage on a larger scale.

10. Irrigation facilities are so great that a general fodder-famine appears to be a most unlikely contingency, but the scarcity may be severe in particular areas (of which the Jumna *khadir* is one) in years of exceptionally light rainfall, or of a cessation so early that the millets give little fodder. Advances to buy fodder will be required in such seasons, and the necessity may possibly arise for importing grass from the sub-montane forests.

In seasons when fodder is scarce owing to drought *juar* occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances if required to enable cultivators to replace cattle that have died from this cause.

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11. The chief measure for the improvement of the water-supply is the promotion of well-sinking in the villages where wells are still required. Loans for this object should be readily given, and a boring staff should be maintained. Any steps that are possible should also be taken to remove the opposition of landholders where it exists: but it is probably only one side of the agrarian question which was formerly so acute in this district, and the most that can be hoped for is that its gradual disappearance may be hastened by influence exerted on individual landholders.

The needs of the country east of the Kali nadi, and especially Shikarpur, should not be lost sight of. It is probable that much fresh light will be thrown on the alkali problem by researches now in progress in the Agricultural department; and the question of giving canal-water to Shikarpur should shortly be re-examined in the light of those researches by the two departments concerned.

12. No further action appears to be required for the improvement of the drainage of the district.

13. To minimise losses from cattle-disease, attention should be given to secure the prompt reporting of outbreaks under the lines laid down in the Land Records Manual, and the veterinary staff should be sufficient to localise outbreaks when they occur.

Any action that may be authorised by Government should be taken to increase the supply of suitable bulls along the Ganges.

14. The district is fairly well provided with agricultural capital for the ordinary needs of ordinary years. There is probably not enough available for well-sinking or other special improvements, and loans for such purposes should be readily given. Agricultural loans can probably be given with advantage in the following cases:—

(a) *Early cessation of the rains.*—There appears to be room (as has been indicated above) for advances

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on a larger scale than was followed in 1907, especially for sowing the rabi and possibly also for planting sugarcane.

(*b*) *Cattle-disease.*—It is desirable to place cultivators in a position to replace working stock without delay.

15. The nucleus of an agency for introducing agricultural improvements requiring associated action exists in the co-operative organisation, the influence of which will probably expand.

As regards improvements in cropping, there is a very wide field for a better cotton when one is available: the varieties of sugarcane will have to be changed if the market should become more favourable for sugar than for *gur* ; and a distinct pressing need is for a leguminous crop sufficiently remunerative to take its place in rotation on the richer land. Groundnuts would apparently serve the purpose if the cost of harvesting is not found to be too great.

The demand for improved tillage-implements should gradually expand, especially in the Jumna *khadir* ; and there is probably room for the cheaper forms of labour-saving machinery.

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DISTRICT NOTE.

ALIGARH.

Topography.

THE district lies between the Ganges and the Jumna but its river-frontage is small owing to the intervention of Etah on the east and Muttra on the west. The trend of its natural divisions is south-eastwards.

On the north-east tahsil Atrauli covers the area between the Ganges and the Kali nadi. The Ganges *khadir* is not extensive: it is fertile and productive, and has benefited greatly by the head-works of the Lower Ganges Canal which keep the river floods under control. Above the *khadir* the land is light and sandy as far as the Nim nadi, westward of which a tract of good loam extends nearly to the Kali nadi with the Chhoya depression in its centre. The land along the Kali nadi is again sandy.

The centre of the district is occupied by tahsils Aligarh, Sikandra Rao and part of Hathras. After leaving the sand of the Kali nadi, there is a belt of highly productive loam down the east of the two first-named tahsils. This merges in the wide central depression, marked by heavier soil with extensive stretches of barren land, largely alkaline. West of this there is again good loam passing gradually into lighter soil.

On the west lie tahsils Khair and Iglas, with pargana Mursan of the Hathras tahsil. The surface of this tract consists of level stretches of loam broken by irregular ridges of sand, with no large depressions. The tract extends to the borders of the Muttra district, but the north-western pargana of Tappal projects westwards as far as the Jumna: it comprises first a stretch of hard loam, then a narrow belt of sand and then the Jumna *khadir*. The *khadir* is mainly a hard and unproductive clay.

A special feature of the district is the presence over large areas of the deep-rooted weed called *baisurai (Pluchea lanceolata)*. It is found mainly in tahsils Iglas and Hathras, and also in scattered villages of Khair and Sikandra Rao. This weed does not as a rule throw the land out of cultivation but it increases largely the labour and cost of tillage, and its presence is inconsistent with high cultivation.

Water-supply.

In tahsil Atrauli the uplands as far as the Nim nadi depend for irrigation mainly on the Anupshahr branch of the Ganges canal, while west of the Nim wells are the only source. The well-capacity is usually good, foundation-clay being almost general and the supply under it copious. The sandy villages on the river banks are, as is usual, short of water.

The eastern side of the central tract (about half of Aligarh and the whole of Sikandra Rao), has excellent supplies from the Ganges canal, while wells can be made in most places. The west side of this tract has hitherto depended on wells. In the west of Aligarh these are still satisfactory: foundation-clay is usually found and the water-level has not fallen greatly. In the west of pargana Hathras however the water-level fell to an extent that rendered irrigation difficult, and the Hathras branch of the canal has just been constructed to meet this difficulty.

On the west, tahsil Khair has recently received increased supplies from the Mat branch of the canal, and the well-capacity is in most places adequate. The water-level has fallen in the southern portion of the tahsil where the new branch runs. Tahsil Iglas and pargana Mursan suffered most by the fall in the water-level: wells are in them still the main sources of irrigation, but the Mat branch now serves portions of the country west of the Karwan nadi, while the Hathras branch

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will serve part of the land on the east. Formerly the water-level in this tract was well above the first layer of foundation-clay, and both masonry and temporary wells could be sunk to it with ease. The fall in level has rendered this layer useless, and wells have now to be carried down to the second layer which is below about 20 feet of sand. The sinking of temporary wells is thus rendered difficult and all forms of wells are much more costly. The new branches of the canal are not designed to replace wells but to supplement them: and it is possible that in time their effect may be to raise the water-level to its former position.

Drainage.

Various portions of the district have suffered in the past from defective drainage, but large sums have been spent in improving the natural channels of the minor streams and in cutting artificial drains, so that there appears to be no longer any risk of widespread injury from over-saturation, and no serious loss has been reported from this cause during the last ten years. The Jumna *khadir* is however liable to recurrent losses by floods on the river.

Cattle-supply.

There are no large grazing areas and consequently no regular cattle-breeding. The number of cows in the district is exceptionally low; the people are inclined to prefer buffaloes for milk-supply. There are few bulls and the local young stock is of poor quality, and is frequently sold to Rohilkhand dealers while immature. The working cattle are largely imported: they are brought by dealers of the district who visit the large fairs in the Punjab and the Batesar fair, and then travel through the district disposing of their stock.

The district is liable to all the common forms of cattle-disease. The practice of preventive inoculation is now welcomed by the people.

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Aligarh.

Annals.

The earlier reports from the district contain little information of permanent value. The west of the disttict suffered somewhat during the drought of 1896, but not so much as to require measures of relief. It was about this time that the fall in the water-level began to attract serious attention, leading to the projects for constructing the Mat and Hathras branches of the Ganges canal. In 1901 wheat suffered from rust, and the early cessation of the rains resulted in poor yields of all staples except cotton. In 1902 the *rabi* was poor owing to continued drought but the following kharif was good. In this year the presence of *baisurai* was reported for the first time, but it is understood that the weed had been present for many years previously.

The yields of the harvest from 1903 onwards were as follows:—

Years.	Rabi.				Kharif.			
	All crops.	Wheat.	Barley.	Gram.	All crops.	*Juar.*	Maize.	Cotton.
1903 ...	84	88	94	81	78	75	87	75
1904 ...	94	94	94	94	100	94	87	100
1905 ...	71	62	81	94	82	75	75	94
1906 ...	87	87	94	81	87	62	87	125
1607 ...	92	75	106	106	54	44	50	62
1908 ...	87	87	94	75	92	100	87	81
1909 ...	84	87	81	87	84	81	87	75
1910 ...	106	106	106	106	83	81	87	81
1911 ...	90	87	94	94	...	...	...	...

In 1903 abnormal rain in October caused considerable injury to millets and cotton, but enabled a very large *rabi* area to be sown for 1904. In this year all crops were good, the only drawback being slight injury to maize from excessive rain in August. In 1905 the frost did serious damage to wheat and *arhar* and also affected other crops; its effects were most serious in the west of the district. The rains began late and were scanty: August was almost rainless, but light falls in September sufficed to save most of the crops and the damage was serious only in the extreme west, the Jumna *khadir* suffering most of all. The rabi area of 1906 was somewhat reduced and the crops suffered from drought in the west of the district but were good elsewhere. There was great scarcity of fodder in the winter of 1905-6, as the growth of grass was unsatisfactory and the usual fodder crops were stunted. The *baisurai* weed was extensively used as fodder, though in ordinary times cattle will not eat it.

The rains of 1906 were heavy and the Jumna *khadir* suffered seriously, but was recompensed by a deposit of fertile silt which ensured a good rabi. In the uplands the crops were good except *juar* which was damaged by strong winds. The winter rains were also above normal and there was severe local damage from hail, while wheat was affected by rust, but the remaining rabi crops of 1907 were good. The rains began only on 25th July and ceased at the end of August, so that the kharif crops suffered severely, and it was noticed that *baisurai* was extending. Rabi sowings for 1908 were made with great difficulty, but rain in January secured good yields except in the case of gram. Extensive suspensions and remissions of revenue were made and advances were given liberally during this season, but no direct measures of relief were found to be necessary.

The rains of 1908 were heavy in August and insufficient in September, but the crops were on the whole good, except in the Jumna *khadir* which was flooded. The ground was too dry for sowing rabi, and a very severe epidemic of malaria which followed the rains interfered seriously with tillage. The rabi area of 1909 was consequently again restricted. The season was favourable until strong winds set in during March, and subsequently the crops on the threshing-floors were damaged by rain in April. The rains of 1909 were heavy in

July when the Jumna *khadir* was again flooded, while they were insufficient in September. The rabi of 1910 was excellent; but the kharif after promising well was injured by excessive rain in September and October which affected the millets and cotton. The Jumna *khadir* again suffered from floods. A large rabi area was sown for 1911, and gave a fair return though injured by excessive rain in March.

Progress.

There has been no material extension of cropping in recent years, and there appears to be little or no room for expansion. The class of cropping has on the whole distinctly deteriorated owing to the decline of indigo: the area under this crop has fallen from over 40,000 to about 2,000 acres, and this has involved a substantial reduction in the wheat area. The place of indigo has ordinarily been taken by cotton, the area under which has risen substantially, and this crop does not serve for the wheat-rotation in the way that indigo served. The area under sugarcane is now extending as is the case throughout the upper doab. The position of other crops shows little change. The practice of sowing certain kharif crops early with canal-irrigation has made a very great advance in the last two decades; about two-fifths of the maize and cotton, and one-sixth of the fodder crops are now sown in this way.

The water-supply of the western side of the district has been injuriously affected by the fall in water-level already mentioned, but against this must be set the construction of the Mat and Hathras branches of the Ganges canal. The number of masonry wells has risen in seven years from 13,730 to 15,591 (one well to 58 acres of cultivation); according to the well-survey there is still room for many more wells, particularly in the western tract and in tahsil Atrauli.

Masonry wells are popular and opposition to their construction was reported from only a few villages (nearly all in tahsil Khair): but in pargana Mursan there was at the time of the well-survey a deadlock between landholders and cultivators which prevented any extension. The view now taken by the local authorities is that temporary wells are more economical in this area, and this is borne out by the fact that the efforts made to distribute advances have had little result. Engineering difficulties were reported to exist in only about 100 villages of the district (which are specified in the records of the well-survey): elsewhere construction is mainly a question of capital.

The drainage of the district has been very greatly improved and apparently little remains to be done in this direction.

The population of the district rose substantially between 1891 and 1901, but the last decade has seen a slight falling off. The population per square mile of normal cultivated area was 734 in 1891, 844 in 1901, and 820 in 1911. Agricultural wages have shown a slight tendency to rise during the last five years, but in 1911 the rates were distinctly below those prevailing in Bulandshahr.

There has so far been no development of agricultural co-operation in the district, though a few societies exist. The facilities for obtaining government loans appears to be appreciated, as in recent ordinary years sums varying from Rs. 12,000 to Rs. 22,000 have been taken for improvements (almost exclusively masonry wells), and smaller sums for temporary requirements.

The only extension of railways in the last twenty years has been the short broad gauge branch from Hathras junction to Hathras city. About 40 miles of road have been metalled during the same period, and the system of main roads is now exceptionally well developed, but some feeder-roads and some bridges are still required.

Statistics of rents are available since 1903-4, when the revision of settlement closed. Occupancy rents then gave an

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average rate of Rs. 5·8 per acre, which rose to Rs. 6 when enhancements were completed, and this rate had not changed up to 1910-11. Competition rents have risen steadily: the average rate was Rs. 7·8 in 1903-4 and Rs. 9·1 in 1910-11.

Seasonal employment has been much reduced by the loss of indigo: sugar-refining is little practised, and indigenous textile industries, though not seriously depressed, have suffered from competition. Among organised industries, ginning and pressing mills have increased largely in numbers, and there are now 23 concerns in the district: cotton-spinning and weaving has been introduced at Hathras, and there has been a considerable development of metal-working, specially lock-making, in Aligarh, where the postal workshops have served as the nucleus of this industry. The government dairy is now a large concern in private hands, and is also finding imitators.

The sums distributed annually by money-order have risen during the last decade from about twelve to about eighteen lakhs. It is understood that a large portion of this income belongs to the city and towns and comparatively little reaches the country.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but large areas are now sown before the rains break, and the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of *bajra*, which can be sown until nearly the end of August. The area under rice is quite unimportant.

The area planted with sugarcane, which is small but increasing, is influenced by the weather in early spring, at

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which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food grains.

2. The yield of maize, the only early dry crop that is grown, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month.

The late dry crops require the prolongation of the rains to about the middle of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The district depends too much for its food on the late dry crops, and a substantial extension of maize is desirable.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. The kharif crops in the Jumna *khadir* suffer from floods during the rains, but there are not grounds for anticipating floods in other parts of the district unless possibly in very exceptional seasons. Serious damage from insect-pests has not been recorded, but should be watched for, particularly in the case of cotton and *juar*. The bollworm (vide Provincial Note, section VI) is believed to exist in the district.

4. The rabi area depends mainly on the rainfall of September and October. It will be reduced when this part of the season is dry, but the fall will not be serious in those parts of the district where canal-water is available for *paleo*-irrigation. The area in the Jumna *khadir* may be reduced if late floods leave the land unfit for sowing.

5. In ordinary seasons, when the seed-bed has been sufficiently moist, the rabi yield does not depend largely on winter rains as the bulk of the crops can be matured with irrigation. Winter rains are however beneficial up to about the middle of February provided the falls are moderate in amount and of short duration. Rain in March or early April may cause some injury, while prolonged periods of damp and cloudy weather between January and March must be expected to produce rust on wheat. The loss may be serious, and its extent may not be fully realised till the crops have been harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring in the early part of January will do little harm except to the *arhar*. Late frosts may cause

serious injury from about the last week of January onwards.

Hailstorms do not become important until the cereals are earing: the danger from them increases as the season advances.

The rapeseed crop may suffer severely from the aphis if damp and cloudy weather occurs while the plants are in flower.

7. The area sown with *zaid* crops in ordinary years is not large, but it may be trebled or more when unfavourable seasons have reduced the stocks of food. No particular dangers are known to threaten this crop.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. The lowering of the water-level in the south-west of the district has produced serious results as has been noted above, and the effect of canal-extensions in this area should be watched.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district but its effects will be most noticeable in the Jumna *khadir* where land will probably go out of cultivation, and where the collection of the revenue will need special attention. The central depression will also require watching in such seasons.

9. Measures of direct relief have not been required in the district in recent droughts, and the conditions in which they may be needed cannot be specified; but the contingency is probably remote. Indirect relief will however probably be required in seasons when the rains have ceased at the beginning of September. The following action was taken in 1907-8:—

Revenue suspended, kharif	1¼ lakh.
" " rabi	½ "
Improvement loans	¾ "
Advances for rabi	2 lakhs.
" " kharif	½ lakh.

Small sums of revenue were also remitted, and about Rs. 5,000 advanced for purchase of fodder.

10. A serious shortage of fodder may occur in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi* system. The demand will depend very largely on the winter rains: if there are none, it may become great outside the canal area, but even light falls bring up enough grass to keep large numbers of cattle going, and the canals enable fodder crops to be raised on a large scale.

A scarcity of fodder does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons *juar* occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances if required to enable cultivators to replace cattle that have died from this cause.

11. The recent extensions of canal-irrigation leave little that can be done, and the further improvement of the water-supply is mainly a question of the construction of wells. Loans should be readily given for this purpose and a boring staff should be maintained to assist in locating sites and also in sinking pipes where the foundation-clay lies deep; it does not appear desirable to press for further well-sinking in pargana Mursan though facilities should be given.

12. There appears to be no need for further drainage works, but possibly some minor improvements will be found necessary when wet seasons recur.

13. To minimise losses from cattle-disease, attention should be given to ensuring the prompt reporting of outbreaks,

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and sufficient veterinary staff should be maintained to localise outbreaks when they occur.

14. The supply of agricultural capital appears to be insufficient and for the present at least there is a considerable field for the *takavi*-system. Improvement loans are wanted mainly for masonry wells. Agricultural loans may be required in the following circumstances :—

(*a*) *Early cessation of the rains.*—Considerable sums may be wanted for sowing the rabi, and possibly also for the following kharif; while if food-stocks are low it may be desirable to offer advances in the spring for sowing *zaid* crops, as well as for planting sugarcane. Advances may also be required to buy fodder.

(*b*) *Floods.*—It may be desirable to give advances to ensure the rabi being sown in areas where the kharif has suffered from floods.

(*c*) *Cattle-disease.*—It is important that cultivators should be in a position to replace working-cattle in time for the next sowing-season.

15. There is at present no effective agency for the introduction of agricultural improvements requiring associated action. It is not likely that the large estates will furnish such an agency in present conditions; the need may possibly be met by the growth of a co-operative organisation, or of associations for improvement.

There is considerable scope for improving the cropping of the district; better varieties of cotton, sugarcane and (possibly) wheat are wanted, and in particular there is need of a leguminous crop sufficiently remunerative to take a place in rotation on the better soils; this need may possibly be met by the groundnut crop. There is undoubtedly room for improved tillage implements in the general agriculture of the district: and probably the control of the *baisurai* weed is largely a question of their use (vide provincial notes, section VIII).

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DISTRICT NOTE.

MUTTRA.

Topography.

THE district is divided by the Jumna into two main tracts: the eastern or trans-Jumna tract includes tahsils Mat, Mahaban and Sadabad, and the western or cis-Jumna includes tahsils Kosi and Chhata. Neither tract is altogether homogeneous, but their sub-divisions have not yet been worked out in detail.

In the eastern tract the land along the Jumna consists mainly of ravines with a small area of *tarai* soil below them; but in places there are sandy slopes, and in tahsil Mat some considerable areas of lowland representing abandoned river-beds; the largest of these is known as No-jhil. Beyond the ravines or sandy slopes there are usually irregular sand-ridges passing into the light loam of the uplands; there are also stretches of sand along the Patwaha nala in the north of Mat and the Karwan or Jhirna nala in Sadabad. Heavy soils are very rare in the uplands, and *jhils* or swamps are practically unknown. The *baisurai* weed is well-established in Mahaban and the west of Sadabad.

In the western tract the land along the Jumna is generally similar to that on the left bank, but there is only one large area of lowland. Away from the river the soil is usually a light loam with very little clay. An ill-defined depression runs through the west of the tract past Gobardhan; it is mainly cultivated and does not serve as a drain. In the extreme west there are a few scattered sandstone hills and the land below them is almost pure sand. Heavy soils, marshes, *jhils* and streams are practically unknown. Most of the tract is distinguished by the absence of valuable trees: the mango is very rare, and the *mahua* unknown. The population is concentrated in a small

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number of large village sites: the formation of hamlets has been checked partly by historical causes, and partly by the difficulty of finding good drinking-water.

Water-supply.

Until recently the eastern tract depended almost entirely on wells, mainly temporary. About the year 1899 it was found that a serious general fall in the water-level was in progress here as in the adjoining tracts of Aligarh: many wells had been left dry and new construction was in abeyance. The water in many parts, especially of Mahaban and west Sadabad is brackish and unfit for use in tillage, though much of it is suitable for application to growing crops; and the diminished supply of water naturally increased the concentration of salts. The project for the Mat branch of the Ganges canal (which had been commenced as a famine work in 1878 but was subsequently abandoned), was therefore revived; this branch was completed in 1906 and supplies most of Mat and Mahaban, and the west of Sadabad. The portion of this tahsil east of the Karwan river will be served by the Hathras branch, now under construction. The effect of the canal on the supply of water in wells has not yet been ascertained.

Masonry wells have been rarely made of late years. The presence of foundation-clay cannot be relied on, and it is absent in many localities; while it is impossible to say beforehand whether the water obtained will be sweet or brackish. No hostility to well-sinking has been recorded, but in the large communities of landholders it is very difficult for an individual to undertake a well. Temporary wells usually require a somewhat expensive lining and if well made last for considerable periods.

The bulk of the western tract has been supplied with water from the Agra canal sine 1875. The distribution has been greatly improved of late, and additional distributaries are under construction to supply the north-east of Chhata and the west of Muttra. The supply of water is however not always adequate to meet the demand in seasons of severe drought. Masonry wells are not being made on a large scale: there is no certainty of finding either foundation-clay or water sufficiently sweet to be of service. The distribution of brackish water is very irregular: it is most common in north-west Muttra and south-west Chhata, but brackish wells are found quite close to sweet wells. Experiments have been made in carrying brackish wells down to the next lower spring; in a few cases the quality of the water improved, but in most cases it got worse. Cheap temporary wells are rarely possible, as an expensive lining is usually required.

Drainage.

There appear to be no records of defective drainage in the uplands of the eastern tract, and no complaints have yet been made of obstruction caused by the new canal; but this point should be kept in view if series of wet seasons recur. Difficulties have been experienced in maintaining works constructed by the landholders to keep the flood-water of the Jumna out of the low area known as No-jhil, and a project for complete reclamation is now under discussion.

The drainage of the western tract has presented a very difficult problem. There is naturally very little run-off and when the canal superseded well-irrigation the water-level gradually rose and flood-water collected on the lower ground. A proposal to open an arterial drainage line through the western depression was abandoned on the ground that it must fail in heavy rain, and drains have gradually been cut to the Jumna as the need was experienced. The drains cannot carry off the whole of a heavy flood at once, but they have secured a very great improvement in the tracts which had suffered most from over-saturation: probably more drains are still needed to complete the system.

Cattle-supply.

The district has very little waste land, and the Jumna ravines are used to graze buffaloes rather than cows. In the

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western tract some villages have regular grazing-grounds (termed *rakhiya*), which are preserved from cultivation by religious sentiment. The stock of cows is not great, but there is a certain amount of concentration along the Jumna: the quality is good, and suitable bulls are available, but the number of cows appears to have fallen seriously during the recent droughts. Cattle are imported mainly from the west; the great distributing centre is the Kosi market, where the local dealers obtain their supplies, but sales are also made by Punjab dealers passing through the district. The proportion of working-cattle to cultivation is much lower than in any doab district.

The district is liable to outbreaks of rinderpest, foot-and-mouth disease and haemorrhagic septicaemia: there is no active hostility to inoculation for cattle-disease, but the practice is not yet welcomed by the people.

Annals.

The district has a long history of distress in times of drought. Its modern annals may be said to begin with the settlement concluded in 1876, which was made at the close of a prolonged period of prosperity. In 1877 the rains failed almost completely and they were again defective in 1878, so that measures of relief were required until the rains of 1879. There was very heavy mortality from fever, and a large amount of emigration took place, especially from villages along the Jumna, when land went out of cultivation. During the eighties the over-saturation of the western tract developed gradually: while cultivation in the south-west of Muttra retreated before the wild cattle of the Bharatpur State. Revenue was reduced where necessary; the drainage of the western tract was begun, and the Muttra boundary was successfully fenced to keep out the wild cattle.

In the nineties the district was fairly prosperous, except for the famine year 1896-7 when relief measures were required from December to July; but the drought of 1899 led to the reduction of the rabi area by almost one-half, and it was then that the fall in the water-level of the eastern tract drew serious attention. In 1901 the rains were again deficient, and the kharif was seriously injured in the extreme west of the district, the south of Mat and the north of Mahaban. The year 1902 was favourable : and in this year the Nandgaon distributary, serving the extreme west of the district, was reported to be complete, while the Mat Branch Canal and the Kosi arterial drain were under construction.

The seasonal yields since 1903 are given in the following table :—

Year.	Rabi.				Kharif.		
	All crops.	Wheat.	Barley.	Gram.	All crops.	*Juar.*	Cotton.
1903	85	100	75	70	80	75	81
1904	94	94	94	87	94	94	94
1905	62	50	50	100	48	25	50
1906	63	75	69	50	94	75	113
1807	89	81	94	94	38	18	50
1908	72	69	81	56	67	62	62
1909	83	81	87	81	76	69	78
1910	83	87	86	80	70	62	69
1911	90	94	94	87	...	...	...

The rabi of 1903 suffered from the want of winter rains, and the kharif was affected first by drought and then by a heavy storm in October. The storm enabled a full rabi area to be sown for 1904 which was a prosperous year. The number of pig were reported to be increasing about this time. In 1905 the exceptional frost of February caused serious injury to the cereals and to minor crops, and plague was exceedingly severe. The rains began late and kharif sowings were restricted, while the falls were quite inadequate throughout the season. The rabi area of 1906 was consequently short, and much of the unirrigated crop had failed before rain came in February. During these seasons there was distress necessitating measures of relief from January to October. Fodder was exceedingly scarce, so much so that cattle were found to eat the *baisurai* weed ; the mortality among cattle was heavy.

The rains of 1906 were more favourable, though the lowlands on the Jumna were flooded, and *juar* was injured by heavy rain at flowering time. The rabi season of 1907 was wet, and wheat suffered from rust and rape from the aphis. The rains of 1907 only lasted five weeks and September was entirely dry. With the aid of very large advances, about two-thirds of the normal rabi area was sown ; the yield in many places was poor as there was not enough moisture to withstand the hot winds of March, and there were complaints of inadequate supplies in the canals. Relief works were found necessary in the spring, and relief measures lasted from January to July.

The rains of 1908 were excessive in August and deficient in September. The failure of a dam in Bharatpur during this season led to flooding in the south-west of Muttra. A large rabi area was sown for 1909 : it suffered from insects after sowing, and rain in April damaged the crops on the threshing floors. The rains were favourable up to the end of August but deficient in September when hot winds prevailed. The rabi area of 1910 fell off, while the following kharif was short owing to inadequate falls in July, and was seriously injured by heavy rain in October. The Jumna lowlands were flooded.

A review of the recent history of the district made in 1911 indicated that its productivity was declining particularly in the western tract, and that probably inadequate tillage was the cause. This view was supported by the results of the census : the population of the eastern tract had fallen by eight per cent, but that of the western tract was reduced by as much as 19 per cent. in the decade. Orders were then issued for a summary revision of the revenue-assessment.

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Muttra.

Progress.

The last two decades have been eventful: on the one side there has been extension of canals, drainage works, railways and roads: on the other the fall of water-level and the serious loss of population and of cattle. With favourable seasons, the loss should gradually be made good and the full value of the gains should then be realised: but at the time of writing it cannot be said that the district has progressed.

The cropped area has for the time fallen off in the western tract, and particularly in Muttra; it is fairly maintained in the eastern tract, but the variations from year to year are large. The proportion of remunerative crops was rising until 1906 but has fallen since. Indigo, which was at one time important has disappeared and wheat has declined: cotton shows an expansion; and there is apparently a tendency to cultivate sugarcane following on the construction of the Mat branch canal.

As regards kharif food-supplies, the district still depends almost entirely on the two large millets which require late rains. Maize appears to be extending slowly in the eastern tract, and should develop under the influence of the canal: attempts made to popularise it in the western tract have not as yet met with success.

The last decade has seen a remarkable extension of the practice of sowing certain kharif crops early with the aid of the canal-irrigation. Nearly half of the large area under cotton and one-third of the maize is now sown this way, as well as a substantial portion of fodder-crops.

The condition of the eastern tract in regard to irrigation has been entirely changed in the last few years by the construction of the Mat branch canal: while in the western tract water has been, or is being, carried to areas that were hitherto unsupplied, and extensive improvements have been made in the drainage. The construction of masonry wells is practically at a standstill.

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Muttra.

As has already been indicated there has been a fall in population during the last decade, serious in the east and very serious in the west. The population in 1911 was substantially less than in 1881 when the district was seriously depressed, and was 16 per cent below the population returned in 1872. Agricultural wages are rising and in 1911 varied from 2½ to 3 annas daily.

Advances for land-improvement are taken with comparative freedom in ordinary seasons and readily absorbed in times of pressure. Advances for temporary purposes are also popular and large sums are required in seasons of drought. There has so far been no development of co-operation in agriculture.

Communications by rail have greatly improved with the opening of the Agra-Delhi line in 1904 and of the Nagda Muttra line in 1909; there was in 1911 one railway station to 90 square miles as against 240 square miles in 1891.

The metalling of the road from Mat to No-jhil practically completes the requirements of the district in regard to metalled roads, but several of the existing roads need costly improvements.

Occupancy rents have not moved appreciably during the last two decades, the average rate having risen only from Rs. 4-2-0 to Rs. 4-3-0 per acre; a large proportion of the occupancy land in the western tract does not pay rent in the ordinary sense, but only the proportionate amount of the revenue and cesses due on the mahal. Competition rents have risen slowly in recent years; the average rate was Rs. 5-6-0 in 1904-5 and Rs. 6 in 1910-11.

Local industries, principally weaving and paper-making, have declined considerably, and the loss of indigo has involved a reduction in seasonal employment. On the other hand the establishment of ginning and pressing mills has proceeded, especially at Kosi, and these afford a substantial amount of employment.

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The sums distributed annually in money-orders have risen in the last decade from about ten to over fourteen lakhs: the sources from which this income is derived have not been ascertained in detail, but some portion represents earnings of employment in Delhi and in Rajputana.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of *bajra*, which can be sown until nearly the end of August. The rice crop is practically unknown.

The area planted with sugarcane which is at present small but tending to expand, is influenced by the weather in early spring, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. But a large proportion of the area is or can be sown before the rains break, and the chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains.

2. The yield of the small area under maize, the only early crop, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month.

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The late dry crops which yield almost the whole of the food-supply, require the prolongation of the rains to about the middle of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most danagerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. The kharif crops in the small areas of lowland may be injured by floods in the Jumna, and floods coming from Bharatpur have also been experienced in the south-west of Muttra tahsil.

Serious injury from insect-pests has not been reported but should be watched for, particularly in the case of cotton and juar. The cotton bollworm (vide Provincial Note, section VI) is believed to be present in the district.

4. In spite of the facilities for irrigation, the rabi area fluctuates greatly: a fall of rain early in October leads to a large extension, while the reduction is very marked when September has been dry. The extent of the reduction is explained in part by the fact that large numbers of wells cannot be used for *paleo*-irrigation though their water can be applied to growing crops.

5. In ordinary seasons, when the seed-bed has been sufficiently moist, the yield of the rabi does not depend entirely on winter rains: these are however very beneficial up to the

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middle of February (or possibly later), provided the falls are moderate and of short duration. Rain in March or early April will probably do some harm while prolonged periods of damp and cloudy weather between January and March must be expected to produce rust on wheat. The loss from this cause may be very serious and its extent may not be fully recognised till the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frosts occurring early in January will do little harm except to *arhar*: but at the end of January or early in February the loss may be very great. Frost may also injure the vitality of the seed-canes, and thus affect both the area and the yield of the next sugarcane crop.

Hailstorms do not become important till the cereals are begining to ear: the danger from them increases as the season advances.

The rapeseed crop may suffer severely from the aphis if damp and cloudy weather occurs while the plants are in flower.

7. The area sown with *zaid* crops in ordinary years is very small: it increases when food-stocks are low but has not been an important resource in recent years.

8. A series of abormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. As has been recorded above the lowering of the water-level may proceed so far as to render the

masonry wells useless in some tracts and it involves an increase of salts in the water, which may make some wells unfit for use.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen almost throughout the district, but its effects will be most noticeable in the low-lying portions of the western tract, where the collection of the revenue will require special attention.

9. Distress requiring some measures of direct relief must be anticipated when the rains have ceased by the beginning of September: its severity will be determined largely by the economic position of the people resulting from previous harvests, but the pressure is likely to be greatest in the villages lying along both banks of the Jumna. The following measures were taken in 1907-8:—

Revenue suspended kharif	Rs. 89,000
" " rabi	" 87,000
Revenue remitted kharif	1⅔ lakhs
" " rabi	2⅔ "
Improvement loans	1 lakh
Advances for rabi	4 lakhs
" " fodder	⅓ lakh
" " kharif	Rs. 15,000

Maximum proportion of population relieved 2·9 per. cent. in February.

10. A serious shortage of fodder may occur in the unirrigated areas in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth: in this case advances for the purchase of fodder will be required: ordinarily this can be procured from the irrigated tracts, but in exceptional seasons importation of grass from the forests may become necessary.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons *juar* occasionally becomes poisonous and the loss of cattle due to this cause may

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be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances if required to enable cultivators to replace cattle that have died from this cause.

11. No large measures can be suggested for the improvement of the water-supply, which has received the special attention of the Irrigation department in recent years. Loans should be readily granted for well-sinking, but the conditions are such that pressure to construct wells would not be justified.

12. The western tract should be watched very carefully in wet seasons with a view to detecting any need for additional drains. The areas in the eastern tract which have recently received canal-water also require watching with the same object.

13. To minimise losses from cattle-disease, attention should be paid to ensuring the prompt reporting of outbreaks under the rules laid down in the Land Records Manual, and sufficient veterinary staff should be maintained to localise outbreaks when they occur. Any action that may be possible should also be taken to educate the people through their leaders in the advantages of protective inoculation.

14. The district is not sufficiently provided with agricultural capital, and in the absence of any alternative source of supply there is a wide field for the *takavi*-system. Improvement loans should be readily given for well-sinking or other useful purposes. Agricultural loans will probably be required in the following circumstances:—

(*a*) *Early cessation of the rains.*—Advances may be required on a very large scale to sow the rabi; and probably further large advances should be offered for the following kharif. Smaller sums may be advantageously given in the spring in villages where sugarcane is grown or where the people wish to sow *zaid* crops.

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(*b*) *Floods.*—Advances may be required in the flooded areas to enable the cultivators to sow rabi.

(*c*) *Cattle-disease.*—Advances may be required to enable cultivators to replace their working cattle by the beginning of the next tillage season.

At the present time the district is undoubtedly short of its requirements both in labour and in cattle-power, and loans may be given freely both for cattle and for labour-saving implements and machinery.

15. There is at present no effective agency for the introduction of agricultural improvements requiring associated action.

As regards cropping, there is very wide scope for a better cotton, and improved varieties of sugarcane are probably needed. There is also need for a leguminous crop sufficiently remunerative to find a place in rotation on the better land; and a greater diversity is desirable in the kharif food-crops.

Special attention should be given to introducing machinery and better tillage-implements in the district so as to make the best use of the cattle-power that is available: better tillage implements will probably aid materially in keeping the *baisurai* weed under control.

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DISTRICT NOTE.

AGRA.

Topography and Water-supply.

THE district contains four distinct tracts, (1) trans-Jumna, (2) Jumna-Utangan, (3) South Khairagarh, and (4) pargana Bah-Pinahat.

The trans-Jumna tract includes parganas Itmadpur and Firozabad. The course of the Jumna is fairly constant and there is little lowland, but the ravines are extensive. Beyond them there is a stretch of sandy soil, and the rest of the tract is level loam, rather light but usually of great natural fertility.

There is a little canal irrigation in the north of Firozabad: the rest of the tract depends on wells, which however cannot be made in the neighbourhood of the ravines. The wells are rarely of masonry, but are usually protected by a wooden cylinder, and last for several years. The water-level at settlement (about 1877) was in Firozabad usually from 30 to 40 feet: in Itmadpur it was usually 50 to 60 and occasionally as much as 80 feet. The supply in the wells was described as somewhat inadequate and the quality as inferior, though usually good enough for agriculture. Foundation-clay is ordinarily present. The water-level has fallen distinctly during the past 15 years. The rabi area has hitherto fallen after an early cessation of the rains, indicating that difficulty is found in preparing land with irrigation: the area sown is however adequately protected. There is practically no *jhil* or tank-irrigation. This tract will benefit very greatly when the distributaries from the new Hathras branch canal are in working order.

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No defects in the drainage of this tract have been reported.

The Jumna-Utangan tract includes the country between these rivers, namely parganas Fatehabad, Agra, and Fatehpur-Sikri, with the north of Khairagarh. There are extensive ravines along the Jumna, and also on the eastern part of the course of the Utangan, but away from these the tract is a level stretch of loam, broken by a shallow depression, known as *dahar*, which serves as a drainage channel for parts of Agra and Fatehabad, and by the Khari nadi, which drains part of the south of the tract.

The water-level in this tract falls steadily from west to east. The tract depends very largely on wells. In Fatehpur-Sikri water is found 20 to 40 feet down, but the subsoil is often such as to make temporary wells impossible, and in many places the water is brackish; it can be used for growing crops, but not in preparing land for sowing as its use at that time prevents the seed from germinating. In Agra water lies at 30 to 40 feet, and temporary wells are usual: here too the water is in some places too salty to be used before sowing. In Fatehabad water is much more distant (from 40 to 60 feet down), but most wells are temporary and the quality of the water is not bad; the supply is, however, inadequate. In the north of Khairagarh the depth to water is from 20 to 40 feet and temporary wells are used. Foundation-clay is ordinarily present. Formerly irrigation from the Agra canal was confined to Agra, Fatehabad and the north of Fatehpur-Sikri; but recent extensions have brought water to the south of of Fatehpur-Sikri and to the north of Khairagarh.

Little damage has been reported from lack of drainage within the tahsil itself, and the affected villages have been drained. There have been occasional floods in the south of Fatehpur-Sikri resulting from vagaries in the upper course of the Utangan, and from the breach of the Ajan embankment in the Bharatpur State. This embankment is several miles

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long, and holds up a great quantity of water: a breach therefore causes moving floods, which destroy the kharif. There has been much difference of opinion as to the effect of these floods: they destroy the kharif, but sometimes they enable a large area to be sown with rabi. When not very severe they are probably beneficial on the whole, though not to individuals; but a flood late in the season has been known to delay or even prevent rabi sowings, and in this case its effect is decidedly evil. In 1891 it appeared probable that the water of the Utangan would gradually transfer itself to the Khari nadi and the question was examined by the Irrigation department. Numerous works were carried out in Bharatpur territory with the object of retaining as much of the flood water as possible and the result was to lessen the frequency and diminish the volume of the floods in this tahsil. Further works have been carried out in the last few years.

South Khairagarh.—There is a range of hills along the north of this tract and numerous hills are scattered through it. The soil varies from loam to sand with occasional patches of clay. Water is near the surface, averaging 10 to 20 feet, but the subsoil frequently prevents the making of temporary wells, and wells of stone or brick predominate. Foundation-clay is not usually present: while in 25 villages the wells are sunk into rock, and are shallow with a supply that is often inadequate.

In a few places embankments have been constructed to hold up water for irrigation; in 1883 it was reported that practically all the small works possible had been constructed by landholders with the aid of advances, but a later report indicated that possibly more could be done, and a large number of projects were examined out of which six have been completed.

There appear to be no defects in drainage.

Bah-Pinahat.—This is a long narrow stretch of land between the Chambal on the south and the Utangan and Jumna on the north. About half the land is occupied by ravines, and the lowland (*kachhar*) is of great importance, especially on the Chambal, the silt of which is very fertile. Between the ravine systems there is a stretch of level upland consisting partly of loam and partly of black soil, similar to the *mar* of Bundelkhand.

Foundation-clay is usually present; temporary wells can be made, and are much more numerous than masonry wells, but irrigation is restricted by the cost of raising water from the great depths at which it is found (60 to 80 feet in the west and 80 to 100 feet in the east of the pargana). There are practically no other sources of irrigation, and the rabi area and yield both fluctuate widely according to the nature of the season; during the last two decades the area has varied from over 55,000 to less than 21,000 acres.

No defects in drainage have been reported; the tract is in fact over-drained, and suffers from denudation.

Cattle-supply.

The number of cows kept in the district is relatively low and their quality inferior: such grazing areas as exist are used mainly by buffaloes. Bulls set aside for breeding are sufficient in number but poor in quality. The working-cattle are largely imported from Gwalior and Rajputana, while much of the inferior young stock produced locally is sold to dealers who take it to the east.

The district is liable to all the common forms of cattle-disease: the practice of preventive inoculation is now welcomed by the people.

Annals.

The current settlement was made at the close of a period of prosperity and was followed by the drought of 1877, and by a disastrous epidemic of fever. The whole district was more or less depressed, but matters were at the time regarded as serious only in Fatehpur-Sikri: here a few villages

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were affected by saturation from the canal, while the whole of the country adjoining the Bharatpur territory was ravaged by wild animals, particularly cattle, which fed regularly off the young crops. Emigration took place on a large scale, and land went out of cultivation and became covered with high grass which afforded fresh cover for the animals. The revenue was reduced in 1886, and further reductions were made in 1890; about the same time the saturated villages were drained, and between 1890 and 1892 the whole of the Bharatpur border from the Utangan northwards was protected from wild animals by a wire fence constructed by Government. The remedy was complete, the land came rapidly under cultivation and the revenue has been enhanced, though not to its original figure. The fence has recently been removed as no longer required.

When the first district report was received in 1895 there was no special cause of depression in any part of the district. The seasons about this time were, however, unfavourable here as elsewhere, and the drought of 1896 found the people already impoverished; the kharif in that year yielded less than half of the normal, and distress was sufficiently severe for the district to be classed as a famine district for purpose of relief; the rabi area of 1897 was greatly contracted. The loss was greatest in South Khairagarh, where the rain was particularly short, and temporary wells could not be made; Bah-Pinahat received more rain, but the rabi was very poor. In Fatehpur-Sikri the kharif was fair, but very little rabi could be sown where the water is brackish.

In 1897 the rains were favourable and distress disappeared. In 1899 the rains were excessive first and very deficient later, and the rabi area of 1900 fell considerably below that of 1897; the fall was greatest in Bah, Khairagarh and Fatehpur-Sikri. From 1900 to 1902 the seasons were on the whole favourable, and the kharif area was large, though the early cessation of the rains kept down the rabi area.

The seasonal yields since 1903 are given in the following table :—

Years.	Rabi.				Kharif.			
	All crops.	Wheat.	Barley.	Gram.	All crops.	*Bajra.*	*Juar.*	Cotton.
1903 ...	79	88	94	62	80	81	75	81
1904 ...	94	94	94	94	87	81	81	87
1905 ...	65	56	56	94	57	50	53	62
1906 ...	60	62	75	50	98	100	94	113
1907 ...	96	87	94	106	48	37	31	50
1908 ...	94	94	94	100	95	100	100	87
1909 ...	94	94	94	94	94	94	94	94
1910 ...	100	100	100	100	85	81	81	75
1911 ...	96	94	94	100	...	...	...	...

The rabi of 1903 suffered from deficient rainfall and dry winds; while the kharif crops were injured by heavy falls in October, and the Utangan flooded parts of Fatehpur-Sikri.

The year 1904 was on the whole favourable, but there were again floods from the Utangan. The exceptional frost of 1905 caused great injury to the cereals, which were sown on a very large scale. The rains of this year were late and the falls were inadequate throughout. The kharif crops were poor, and the rabi of 1906, which was much reduced in area, suffered from the dryness of the soil and from hot winds, while local damage from hail was very severe in the south of the district. During these seasons suspensions and remissions of revenue were granted, and advances made for temporary wells; famine was declared in Fatehpur-Sikri, Khairagarh and Bah, and relief measures lasted from March till October.

The presence of the weed *baisurai* was now reported, but it had been in existence for some time: it was found to be prevalent in parts of all tahsils except Bah. The improvement of the water-supply was in hand: some reservoirs were constructed in South Khairagarh, and considerable extensions of the canal were made in Fatehpur-Sikri and North Khairagarh.

Distress disappeared as the excellent kharif of 1906 matured, and the rabi of 1907 was again good, with the exception of wheat, which suffered from rust. The rains of this year were however a failure: they began in the last week of July and practically ceased at the end of August, and a large proportion of the crop was lost, while sowings for the rabi of 1908 were much contracted. Revenue was suspended and remitted, and very large sums advanced for various purposes; direct relief operations, including large works, were in progress from January to June. The distress was however not serious; the maximum number relieved being less than two per cent. of the population.

Recovery was again rapid. The rabi of 1908 was a good crop though the area was small; and the rains were on the whole favourable, particularly to food crops, though parts of Fatehpur-Sikri suffered from the Utangan floods. The year 1909 was favourable and the rabi of 1910 was exceptionally good. The rains of this year were light at the start and kharif sowings were reduced; heavy falls in September and October injured cotton and the millets, but enabled a very large rabi area to be sown for 1911 and this yielded well.

Progress.

The cropped area has risen slightly during the last two decades, but the rise is really a recovery, and there has been no extension of cultivation, nor is there room for it. The proportion of remunerative crops is much lower than in the upper doab, and is apparently tending to fall. Cane is very little grown and is not extending, cotton shows no marked advance, and wheat has fallen appreciably, while indigo (which occupied about 6,000 acres) has disappeared.

No new staples have become important.

The practice of sowing certain kharif crops early with the aid of canal irrigation has made considerable progress in the last decade, and about 15 per cent. of the area under maize, cotton and fodder is now sown in this way.

There has been very little advance in the number of masonry wells, cultivators adhering to the temporary wells where they are effective. In 1911 there was one masonry well to 72 acres of normal cultivation as against 77 acres in 1905; such increase as has occurred is proportionately greatest in the trans-Jumna tract. This tract is about to benefit from the Hathras branch canal. Tahsil Bah has no additional supplies, but the south of the Jumna-Utangan tract has benefited very greatly by the extensions of the Agra canal. The additional reservoirs constructed in South Khairagarh are proving of material benefit to their locality.

The population rose by 57,000 between 1891 and 1901, but there has been a decrease of close on 40,000 during the last decade. Agricultural wages do not appear to have risen materially during the last five years: in 1911 the commonest rate was 2½ annas.

Takavi advances have in the past been taken on a moderate scale in ordinary years both for improvements and for temporary purposes. Advances in 1905-6 aggregated three lakhs and in 1907-8 close on 13 lakhs, and since then substantial amounts have been taken annually for improvements. There has been as yet no development of agricultural co-operation; one small rural credit society existed in 1911.

The only new railway constructed in the last twenty years has been the broad-gauge connection with Delhi, which is more important as a through route than for developing local traffic. Several additional stations have been opened on existing lines and there is now one station to 98 square miles as against 231 square miles in 1891. The south-east of the district is still without railway facilities. The mileage

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of metalled roads has been considerably increased, but some feeder roads and some bridges are still required.

The rents payable by occupancy tenants have remained practically unchanged in the last two decades; the recorded rents give an average rate of Rs. 4·5 per acre throughout the period. Competition rents rose very slowly for the first 15 years, ranging from Rs. 4·9 to Rs. 5·3: the rise in the last five years has been rather more rapid, the records for 1910-11 giving a rate of Rs. 5·6.

Among rural industries weaving has declined and the disappearance of indigo has involved the loss of seasonal employment. Stone-quarrying in the south of the district has developed of late years.

Organised industries in the city show steady development in cotton spinning and weaving, carpet-making and minor branches; while ginning and pressing mills have increased considerably in the district.

The sums distributed annually by money-order have risen in the last decade from about 20 to 31 lakhs: it is understood that the rural areas have a comparatively small share in this income.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of *bajra* which can be sown until nearly the end of August. The area occupied by rice is insignificant.

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Agra.

The small area planted with sugarcane is influenced by the weather in early spring, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains.

2. The yield of maize, the only early crop that is sown, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month.

The late dry crops require the prolongation of the rains to the middle of September or later: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

Apart from the small area under maize the district depends for its kharif food supply entirely on the large millets and associated crops: a large extension of maize is most desirable in order to ensure against drought in September.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

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Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. Apart from variations in the rainfall, the chief danger to the kharif arises from the floods of the Utangan: it is not yet known whether the works recently carried out will suffice to prevent flooding in future. No serious injury from insect-pests has been reported, but it should be watched for, particularly in the case of cotton and *juar*. The boll-worm (vide Provincial Note, section VI) is believed to exist in the district.

4. The rabi area depends mainly on the rainfall of September and early October. Late rain results in a large expansion, while a dry September means a reduction which is general but is most noticeable in Bah.

The area in the south of Fatehpur-Sikri may be reduced by an exceptionally late flood from the Utangan.

5. Winter rains are important for the rabi in all seasons, though the irrigated tracts can dispense with them. Falls are beneficial up to about the middle of February provided they are moderate in amount and of short duration; falls at the end of the season are somewhat injurious, while prolonged periods of damp and cloudy weather between January and March must be expected to produce rust on wheat. The injury from this cause may be very serious, and its extent may not be fully realised till the crop is harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring early in January is not likely to do much harm except to *arhar*: but towards the end of that month or early in February very severe injury may result.

Hailstorms are of little importance until the cereals are beginning to ear: the danger from them increases as the season advances.

The rapeseed crop may be seriously injured by the aphis if damp and cloudy weather occurs while the plants are in flower.

7. The area sown with *zaid* crops in ordinary years is quite unimportant, but a relatively great expansion occurs when stocks of food have been reduced by bad harvests.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. The lowering of the water-level may proceed so far as to render some of the masonry wells useless in some parts of the trans-Jumna tract and in the rocky parts of South Khairagarh.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will probably be most noticeable in the lower portions of Fatehpur-Sikri.

9. Distress requiring some measures of relief must be expected to occur when the rains have ceased at the beginning of September. Its incidence will probably be greatest in the southern parts of the district, and possibly also in the

llage along the Jumna. The following measures were
ken in 1907-8 :—

Revenue suspended, kharif	2½ lakhs.
" " rabi	Rs. 14,000
Revenue remitted, kharif	2⅓ lakhs.
" " rabi	1⅓ "
Improvement loans	4⅓ "
Advances for rabi	5¾ "
" " kharif	1⅓ lakh
" " fodder	1 "

aximum proportion of population relieved 1·8 per cent. March.

10. A serious shortage of fodder may occur in the untry not commanded by canals in seasons when the rains ve ceased so early that the large millets wither altogether are seriously stunted in growth: in this case the offer of vances should ordinarily be sufficient, but in very bad asons the importation of grass from the forests and its distribution on the *takavi*-system may become necessary. The mand will depend very largely on the winter rains: if there none, it may become great, but even light falls bring up ough grass to keep large numbers of cattle going.

A fodder famine does not necessarily occur when the llets yield no grain, as the plants may have grown to a ficient size to yield fodder; but in such seasons *juar* occanally becomes poisonous and the loss of cattle due to this use may be considerable. The poison is formed under the normal conditions of growth, and its presence cannot be ognised beforehand except by analytical methods; the y action possible is to provide advances if required to able cultivators to replace cattle that have died from this use.

11. The water-supply of the trans-Jumna and Jumnangan tracts has been greatly improved by extensions of canal-system, and probably not much more can be done

in this direction at present. Facilities should be given in these tracts for the construction of masonry wells, loans being readily given and a boring staff maintained to assist in locating sites.

In South Khairagarh the policy of constructing reservoirs should be steadily pursued till every possible site has been utilised, and facilities should be given for sinking masonry wells. It is desirable that enquiries should be made in the villages where the wells are sunk in the rock, in order to ascertain if the people require assistance to deepen these: in Jhansi much good has been done by giving advances for this purpose, and by arranging for dynamite where the rock is too hard for country methods; dynamite is probably unnecessary in this case, but the facts should be ascertained.

In tahsil Bah direct improvements in the water-supply cannot be suggested, but the desirability of field-embankments should be examined (vide Provincial Note, section II).

12. There appears to be no need of additional drainage-works at the present time, but the areas where canals have recently been introduced should be watched when wet seasons recur, and any defects in the drainage system should be promptly remedied.

13. To minimise losses from cattle disease, attention should be given to securing prompt reports of outbreaks under the rules contained in the Land Records Manual, and a sufficient veterinary staff should be maintained to localise outbreaks where they occur.

14. The district is not well supplied with agricultural capital, and pending the growth of a co-operative organisation the *takavi*-system should be liberally worked. Improvement loans may be required—

(*a*) for masonry wells;

(*b*) for constructing or repairing reservoirs in south Khairagarh;

(*c*) for deepening rock-wells in South Khairagarh;

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(*d*) possibly for field-embankments in Bah.

Agricultural loans may be required in the following circumstances :—

(*a*) *Failure of the rains.*—Money may be wanted on a very large scale to sow the rabi ; and probably also for the following kharif. Small sums may be wanted in the early spring by sugarcane-growers, or to enable *zaid* crops to be sown ; and advances to buy fodder may also be needed.

(*b*) *Floods.*—Money may be required to sow rabi where the kharif crops have been injured, and especially where homesteads have been destroyed or cattle lost.

(*c*) *Cattle-disease.*—It is important that cultivators should be in a position to replace working-cattle by the beginning of the next tillage-season.

15. An agricultural association was recently formed in the district, but its effectiveness as an agency for introducing improvements is still doubtful : some of its members however may be relied on within their own localities.

As regards cropping, there is ample room for a better cotton when one is available : existing varieties of sugarcane can probably be replaced with advantage : extension of the growth of maize is most desirable ; and there is need for a leguminous crop sufficiently profitable to take a place in the rotation on the better soils. Probably also the wheat now grown can be replaced by better varieties.

The tillage of the dry areas requires to be studied from the point of conservation of moisture : in the district generally there is probably scope for the cheaper forms of improved tillage-implements, and the use of these would probably aid in the control of the *baisurai* weed (vide Provincial Note, section VIII).

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DISTRICT NOTE.

MAINPURI.

Topography.

THE district is divided into three natural tracts lying east and west. On the north is the sand belt between the Kali nadi (which bounds the district) and the Kaknadiya and Isan rivers. This tract covers about one-sixth of the district, and includes parganas Dewar and Alipur Patti, and the northern portions of Kishni, Bhongaon, Kuraoli and Mainpuri. The soil is sandy, most so along the rivers, and less in the central plains which in one part near Bhongaon includes a stretch of clay and *usar*. This tract is subject to the effects of adverse seasons, the sandy soil giving poor crops both when too wet and when too dry: in the past drought was a serious danger, but it has been greatly mitigated by the construction of the Bewar branch canal. In wet years the sandy land may be overrun with *kans*. The Kali nadi has a considerable extent of cultivated lowlands: some of this land is ordinarily very productive, but it rapidly becomes waterlogged in wet seasons and is then unculturable.

The central loam belt lies between the Kaknadiya and Isan on the north and the Sarsa on the south, and is traversed by Arind and the Sengar. There is a belt of sand along the Isan, and south of the Sengar the land gradually changes to a condition resembling the southern tract; with these exceptions it is a very fertile loam, interspersed with *jhils* and *usar* plains. This tract covers nearly two-thirds of the district and includes the whole of parganas Karhal, Ghiror and Mustafabad; the south of Kishni, Bhongaon, Mainpuri and Kuraoli; and

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portions of Barnahal and Shikohabad. The *baisurai* weed is present in many places but affects seriously only portions of Mustafabad and Shikohabad.

The southern tract includes the rest of Shikohabad from the Sarsa to the Jumna, and strictly speaking includes also that part of Barnahal which lies between the Sarsa and the Sengar: it covers about one-third of the district. The soil is as a rule a sandy loam unbroken by *jhils* or *usar*, but on the south passing into the extensive Jumna ravines, below which is found *kachhár* land of high value.

Water-supply.

The northern tract is in many places unfavourable to well-construction: the sub-soil is often too light for unprotected wells, and foundation-clay is not met with along the Isan and Kali nadi. A large proportion of the tract is watered effectively by the Bewar branch canal. Other sources of irrigation are unimportant. The drainage of this tract appears to be satisfactory.

The central tract as far south as the Sengar receives large supplies from the Cawnpore and Etawah branch canals, and—except along the Isan—foundation-clay is almost uniformly met with. The areas where irrigation is deficient are (*a*) some of the land along the Isan on the north: (*b*) the south-east of pargana Kishni: (*c*) parts of Mustafabad where the water is brackish: (*d*) the south-west of the same pargana where the water-level has fallen. There are considerable numbers of masonry wells, and practically no hositility to their construction has been reported, while the temporary wells so largely used are substantial and often remain efficient for several years. A substantial amount of irrigation is done from *jhils* in ordinary seasons, and the Isan and Arind are also used and are dammed annually. The natural drainage of this tract proved to be very inadequate, and drainage works have been carried out on a large scale; it is believed that only local defects remain.

The southern tract receives substantial supplies of water from the Bhognipur branch canal, but wells are the chief sources of irrigation. Masonry wells are relatively few: but the temporary wells are usually carried down to the foundation-clay which is present in nearly all villages, and they remain efficient for a number of years. The principal area where there is difficulty in irrigation is the land along the Jumna ravines, where the water-level is very low. Most of this tract is adequately drained, but there is some over-saturation along the Bhognipur branch which is at present the subject of investigation.

Cattle-supply.

The number of cows kept in the district is relatively very small, buffaloes being preferred for the domestic milk-supply and for the *ghi* industry. Breeding-bulls are few and inferior, and there is no regular breeding-industry, nor is there room for one. Working stock are largely imported by dealers from the Punjab and from Gwalior, or are purchased at the Batesar fairs; frequently Punjab bullocks are brought young, worked till mature and then sold into the upper doab. The inferior local stock is taken by dealers for sale in South Oudh.

The district has not suffered recently from rinderpest, but foot-and-mouth disease and haemorrhagic septicaemia are common: there is no active hostility towards the practice of preventive inoculation, but it is not yet welcomed by the people.

Annals.

The district suffered very severely from the famine of 1837-38 and from its after-effects which led to a collapse of the settlement. A long period of prosperity followed; and the effect of the droughts of 1861 and 1868 were felt only in the unirrigated villages and even there were not severe. In the famine year 1877, distress began to appear in August, and increased in January after field work for the rabi was over; it continued through the hot weather and until the following kharif was reaped. It was most severe in the southern tract.

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About this time the saturation of the Kali nadi valley attracted attention and 70 villages were brought under short settlements at reduced jamas. These jamas were revised and slightly raised in 1881, to continue until the settlement should expire. In 1887 however serious injury from floods was reported all along the Kali nadi in Mainpuri and the neighbouring districts. Reductions of revenue were found necessary ; further enquiries were at the same time ordered, and a special officer was deputed for the work in 1890. As regards the Kali nadi valley, it was found that the revenue fixed in 1881 was paid without difficulty until the great flood of 1885 on that river, which ruined the kharif and entirely destroyed the resources of many cultivators. The settlement of the villages was again revised.

Two other tracts came under enquiry at the same time. One is spoken of as the *kans* tract and includes about 70 villages lying in the country between the Kali nadi and the grand trunk road. During the wet seasons the weak sandy land became oversaturated and went out of cultivation, the crops being so poor as to be unprofitable. *Kans* occupied the vacant land, and the impoverished cultivators had not the means to keep it down. Reductions of revenue were necessary in this tract. The other tract included some fifteen villages in Shikohabad and Mustafabad where the introduction of the Bhognipur branch canal had led to local injury from obstructed drainage.

In 1895 when the first annual report was submitted, no general deterioration was brought to light, but the need of drainage was indicated in certain localities and the necessary works were carried out by the Irrigation department. In the drought of 1896 the kharif was seriouly affected, the southern tract suffering most ; the yield for the whole district was less than 50 per cent. of the normal. The district was classed as suffering from scarcity, not famine, and at no period was any

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large number employed on relief works. The rabi area of 1897 was short by from 20 to 25 per cent. in parganas Kuraoli, Barnahal and Shikohabad, but elsewhere was fairly well-maintained and the yield was good. In 1897 the loss of cultivated area was at once recovered, and no further injury was reported until the early cessation of the rains of 1899, when parts of Barnahal and Shikohabad again suffered loss from drought.

In 1901 a prolonged break in September was injurious to all crops except cotton. In 1902 the rabi crops suffered from exceptionally strong winds in March, the poppy being especially affected ; in this year the rainfall was inadequate and maize and other food crops suffered. The report for this year noticed that *kans* had largely disappeared, but that *baisurai* was spreading.

The seasonal yields since 1903 are given in the following table :—

Year.	Rabi.				Kharif.			
	All crops.	Wheat.	Gram.	Poppy.	All crops.	*Juar.*	Maize.	Cotton.
1903 ...	100	100	75	100	(*a*)	75	94	44
1904 ...	(*a*)	94	100	94	81	81	69	75
1905 ...	79	69	112	87	(*a*)	75	87	94
1906 ...	86	87	62	100	99	87	106	106
1907 ...	85	75	87	87	57	50	75	62
1908 ...	81	81	62	62	65	75	69	44
1909 ...	81	75	87	75	84	75	87	75
1910 ...	100	100	100	100	81	50	100	75
1911 ...	97	94	113	50	...	...	...	...

(*a*) Area figures not available.

The rains of 1903 were very late and in October heavy falls with strong wind injured the cotton and millets ; the Kali nadi and other rivers came down in flood, but subsided in time to allow of rabi sowing. In 1904 the rainfall was excessive in August and deficient in September. The

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exceptional frost in January and February 1905 destroyed the *arhar*, and caused severe injury to the wheat crop especially in the lighter soils. The rains began late and were deficient in July and August; most of the district secured a moderate kharif crop, but the yield was uneven, and supensions of revenue were required in some villages in the southern tract and in the south-east of pargana Kishni. The rabi area of 1906 was somewhat contracted owing to the drought, and the winter rains were indequate so that unirrigated crops suffered. The next two harvests were favourable except that wheat suffered from rust.

The rains of 1907 lasted only from 22nd July to 27th August. The kharif crops suffered severely, and the rabi area of 1908 was restricted. The demands on the canals were in excess of the available supply, and the need for more masonry wells was felt. Advances were given for improvement and for temporary needs, and a small number of persons received gratuitous relief from January to April, but there was no serious distress. The extension of *baisurai* was again brought to notice.

The rains of 1908 were again late and were deficient in September; irrigation was required for rabi sowings, and an extensive outbreak of malaria in the autumn interfered seriously with field-work, so that the rabi area of 1909 was curtailed. The winter rains were untimely and some loss was caused by heavy falls in April. The rainfall was once again deficient in September, but a larger rabi was sown for 1910, and gave an exceptionally good yield. In this year the monsoon rains were at first so deficient as to restrict kharif sowings, while exceptional falls in October caused floods on the rivers and injured the millets and cotton. A large rabi area was sown for 1911 and all crops did well except the poppy which suffered from rain in March.

Progress.

The district is fully cultivated and no material extension of the cropped area has occurred recently or is to be expected.

The irrigation facilities make the seasonal fluctuations in area of relatively small importance.

The proportion of land devoted to remunerative crops is on the whole constant. Indigo which twenty years ago occupied nearly 30,000 acres, has practically disappeared, and there is a slight fall in the area under wheat. Sugarcane shows no advance, but cotton has extended considerably, and potatoes and garden crops are now locally of some importance. The area under poppy rose for some time and in 1906 was over 27,000 acres, but is now much reduced.

The practice of sowing certain kharif crops with the aid of canal-irrigation has developed remarkably during the last decade, and in 1910 the area so sown exceeded 50,000 acres and comprised one-half of the maize, nearly one-half of the cotton, and one-third of the fodder; but in this season the rains were very late, and in ordinary seasons about one-third of the crops named taken together will be sown with irrigation.

The facilities for irrigation from canals have not increased materially during the last twenty years, but the drainage system has been very greatly improved. The construction of masonry wells received a stimulus from the droughts of 1905 and 1907, and in 1911 there was one such well to 44 acres of normal cultivated area as against 49 acres in 1906. The extension of these wells has been least in the southern tract, where the people rely on the efficient temporary wells, but there are signs that the popularity of masonry wells is increasing in this tract also.

The census of 1901 showed a rise in population but a fall was recorded in 1911, the figures for which year are only slightly in excess of those for 1891. Agricultural wages appear to have risen slightly in the five years, and in 1911 something over two annas was usually paid.

The demand for advances for improvements (almost entirely masonry wells) has increased in recent years, as the result of seasons of drought, and nearly ¼ lakh has been taken in the last three years. Advances for temporary purposes are taken only in exceptional years, but the demand may then be large. There has been a considerable development of agricultural co-operation ; in 1911 there were 61 rural credit societies with 2,302 members, and adequate working capital was provided by the district bank. Further development appears likely to be rapid. An agricultural association is closely connected with the co-operative movement, and appears likely to produce practical results.

Twenty years ago the district was almost outside the scope of the railway system, the East Indian main line passing only through the extreme south-west corner. The Shikohabad-Farrukhabad line now passes through the centre from south-west to north-east, and there is one railway station to 196 square miles. The district is fairly well provided with metal roads, but the mileage has not increased greatly in recent years.

No rental statistics are available for the years from 1899 to 1906 during which survey and settlement operations were in progress. After settlement the rents of recorded occupancy tenants gave an average rate of Rs. 4·7 per acre, which has since been raised to Rs. 4·9 as the result of enhancements. The recorded competition rents in 1906-7 gave an average rate of Rs. 5·8, which had risen rapidly to Rs. 6·5 in 1910-11.

The district has lost a considerable amount of seasonal employment owing to the decline in indigo, and the local textile industries have suffered from competition. The indigenous glass industry is of some importance and is well-maintained, while the extraction of crude saltpetre is of growing importance ; the product is largely sent to Farrukhabad for refining. Organised industry is represented only by ginning and weaving mills, which industry centres in Shikohabad.

The district does not derive a large income from external sources. The sums distributed annually in money orders have

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risen in the last decade from about five to about seven lakhs annually, and a very large proportion is known to represent local transactions.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of rice, and also of *bajra*, which can be sown until nearly the end of August. Early rice is ordinarily sown on a very small area.

Late rice requires a wet second month, and the area under it falls very largely if there is prolonged fine weather at this period.

The area planted with sugarcane is influenced by the weather in early spring, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. A large proportion is however now sown before the rains break, and the chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains.

2. The yield of maize, the only early dry crop that is grown to any extent, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much

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reduced by excessive rain in the second month. The small area under early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains to the middle of September or later : they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The late rice requires more rain in September than is suitable for the dry crops, and where canal water cannot be had at least one fall in October is desirable for its complete success.

The distribution of the area between early and late food-crops is fairly satisfactory, but a somewhat more extensive growth of maize would be an additional safeguard.

The sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather : the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains : a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain : the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. The kharif along the rivers may suffer from floods, but the area affected is not extensive. Serious injury caused by insect-pests has not been reported but should be watched for, especially in the case of cotton and *juar* ; the bollworm (vide Provincial Note, section VI) is believed to exist in the district.

4. Fluctuations in the rabi area are comparatively slight as moderate deficiencies of moisture are made good by *paleo*

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irrigation, but it will fall when September has been dry, and the fall may be substantial in the areas where canal-water is not available.

Late floods on the Kali nadi and other rivers may reduce the area sown in the lowlands by leaving the ground too wet for tillage.

5. In ordinary seasons, when the seed-bed has been sufficiently moist, the bulk of the rabi crops can be matured without winter rains ; these are however beneficial up to the early part of February provided the falls are moderate and of short duration. Rain in March or early April will probably do some harm, and prolonged periods of damp and cloudy weather between January and March must be expected to produce rust on wheat. The loss from this cause may be serious, and its effects may not be fully realised till the crop is harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case : a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frosts occurring early in January do little harm except to *arhar* and potatoes ; a frost at the end of the month or early in February may cause very serious injury.

Hailstorms are of little importance until the cereals begin to ear : the danger from them increases as the season advances.

The rapeseed crop may suffer severely from the aphis if damp and cloudy weather occurs while the plants are in flower.

A watch should be kept for the appearance of the potato-moth which causes serious injury (vide Provincial Note, section VI).

The poppy crop is liable to serious injury from damp weather late in the season.

7. The area sown with *zaid* crops in ordinary seasons is very small, and it does not expand greatly in years when food-stocks are low.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render some of the masonry wells useless; this danger is apparently real in the south-west of Mustafabad.

On the other hand, a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the sand tract on the north of the district, and in the lowlands on the rivers. The collection of revenue in these areas should receive special attention in such seasons, and any tendency towards a fall in cultivation should be regarded as a serious symptom.

9. Distress requiring some measures of relief must be expected to occur if the rains have ceased at the beginning of September; it will probably be more felt in the northern and southern tracts than in the centre of the district.

The following measures were taken in 1907-8 when very little direct relief was required—

	Rs.
Revenue suspended, kharif ...	... 55,000
,, ,, rabi ...	... 6,000
Revenue remitted ,, ...	... 5,000
Improvement loans ...	... ¼ lakh
Advances for rabi ...	... 1⅓ ,,
,, ,, kharif ...	... ½ ,,

Maximum proportion of population relieved 0·2 per cent. in March.

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10. The irrigation-facilities are so great that a fodder-famine appears to be a very improbable contingency, and the conditions in which it must be expected cannot be formulated. In dry seasons there may be local deficiencies, especially in the south of the district, but it should be possible to meet these by advances.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder ; but in such seasons *juar* occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods : the only action possible is to provide advances if required to enable cultivators to replace cattle that have died from this cause.

11. There is not much to be done to improve the water-supply of the district beyond facilitating well-sinking by the ready grant of loans and by maintaining a boring-staff to assist in locating sites. There may be scope for power-pumping along the Isan and Arind rivers.

12. There is at present some water-logging along the Bhognipur branch of the canal in the southern tract, and investigation is in progress to devise a suitable remedy. Elsewhere no drainage works are known to be needed. But possibly minor defects in the system may become noticeable in wet seasons.

13. To minimise losses from cattle-disease, attention should be given to securing prompt reports of outbreaks under the rules contained in the Land Records Manual, and sufficient veterinary staff should be maintained to localise outbreaks where they occur Any action that is possible should also be taken to educate the people in the advantages of protective inoculation.

14. The district is insufficiently supplied with agricultural capital. The need is to some extent being met by the

extension of the co-operative organisation, but there is still a wide field for the *takavi*-system. Improvement loans are required mainly for well-sinking : agricultural loans may be wanted in the following circumstances :—

(*a*) *Early cessation of the rains.*—Advances will be wanted on a large scale for sowing the rabi, and possibly also for the following kharif : and small sums may be wanted in the winter and early spring for buying fodder, planting sugarcane, or sowing *zaid* crops.

(*b*) *Floods.*—Advances may be required on a small scale for sowing rabi in villages where the kharif has been seriously injured.

(*c*) *Cattle-disease.*—It is important to ensure that cultivators are in a position to replace working-cattle by the beginning of the next tillage-season.

(*d*) *Curtailment of the poppy area.*—It may be desirable to offer advances in villages where the crop has been largely grown to enable cultivators to substitute some other remunerative crop.

15. Improvements in agriculture requiring associated action can already be initiated in some places through the co-operative origanisation and the closely allied agricultural association, and it is probable that the growth of these institutions will eventually furnish a satisfactory agency over a large portion of the district.

As regards cropping, there is a wide field for a better cotton; the varieties of sugarcane can probably be replaced with advantage ; and there is room for a leguminous crop giving produce of sufficient value to take a place in the rotation on the better soils. Improved tillage-implements would be of value almost throughout the district, and in particular would probably be useful in controlling the *baisurai* weed (vide Provincial Note, section VIII); while there may be room for small labour-saving machinery , including power-pumps.

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DISTRICT NOTES.

ETAH.

Topography.

THE district is divided into four natural tracts—

The *tarai* which lies between the Ganges and the high bank south of the Burhganga, including parganas Faizpur Badaria, Aulai and Nidhpur, and portions of Soron, Patiali, Pachlana, Sahawar and Azamnagar. This tract covers about 400 square miles, but its area is being reduced by diluvion. The lower parts contain rich fertile soil, while the higher ridges are sand; irrigation is usually unnecessary but wells can be made when required.

The *central doab*, which extends from the high bank southwards to the Kali Nadi, and includes most of Pachlana, Bilram, Soron, Sahawar, Sirpur Patiali, Azamnagar and Barna. There is a strip of high sandy land along the high bank on the north and another along the Kali on the south: their width varies so that in places they almost join, while elsewhere they are separated by level plains of firmer soil shading off in the centre to clay and *usar*.

The Kali Nadi valley.—This varies in width, but there is throughout a stretch of cultivated land, ordinarily highly productive, but exposed to great risks. Floods late in the season may leave it too wet to sow with rabi, and in exceptional floods deposits of sterile sand are sometimes formed. Kharif crops are naturally little sown.

The *south-western tract*, containing Jalesar, practically the whole of Etah, Sakit and Marehra, most of Sonhar and part of Bilram. In this tract there is a line of *bhur* along the south bank of the Kali Nadi; the prevailing soil is rich *dumat*, interspersed with *usar* plains. The soil is heaviest along the line of the Isan which assumes the character of a river in this district: south of this line the soil gets gradually higher towards the Jumna.

Water-supply.

The *tarai* and the *Kali valley* do not ordinarily require irrigation; water can usually be obtained if needed in the former from temporary wells and in the latter from the river.

The *central doab* is largely commanded by the Fatehgarh branch canal, while both permanent and temporary wells can be made in considerable areas. Temporary wells are however most unsatisfactory in the sandy tracts, while foundation-clay has not been located in the land along the high bank on the north and along the Kali Nadi on the south. Masonry wells have increased rapidly in the tract during the past few years, and very little hostility to them was recorded during the well enquiry. At settlement the south and centre of pargana Azamnagar was described as the most liable to suffer in drought; proposals for supplying canal-water in this tract are under discussion.

The *south-western tract* has a well-developed canal supply: the only deficiency has hitherto been in the south-west of Jalesar, but this area will be served by the Hathras branch now under construction. Foundation-clay is known to exist almost universally, except on the Kali Nadi bank, and temporary wells are usually possible. The number of masonry wells has increased less rapidly of late than in the central doab, and hostility on the part of landholders was reported in 27 villages (14 of which are in pargana Etah). The water-level falls towards the west of Jalesar, and the water found there is frequently too brackish for use before sowing, though it can be used for after irrigation; the *baisurai* weed is established in this part of the country.

Drainage.

In Etah the drainage question is of such importance as to require special attention. The natural drainage of the

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south-west tract is fairly good and has been considerably improved; it is believed now to be satisfactory, but has not been fully tested. The rest of the district will need very careful watching on the recurrence of a series of wet seasons.

The Kali valley depends for its prosperity on the river falling in time to let the land dry for rabi-tillage: late floods may leave much of it waterlogged.

The natural drainage of the central doab is exceedingly bad: most of the rainfall soaks into the ground, and the water-level, which ordinarily is high, rises rapidly in wet years, while it sinks very slowly after the wet years are over. With a high water-level the land goes rapidly out of cultivation, and gets covered with *kans* grass. Extensive drainage works have been carried out in the last twenty years, but they have not yet been fully tested, and when wet seasons recur the movement of the water-level should be watched very carefully.

In the *tarai* the villages drained by the Burhganga have in the past suffered very severely from water-logging: the channel of the river has been rectified, but the work has not yet been tested by wet seasons, and this tract also requires careful watching.

Cattle-supply.

The stock of cows in the upland tracts is relatively very small, buffaloes being preferred for dairying. There is however a considerable stock of cows kept in the *tarai* and along its edge, specially in parganas Nidhpur and Patiali; there are no large individual breeders, but owners of small herds are numerous. The cows graze in the *tarai*, where there is a great scarcity of bulls. Breeding is kept down by this fact, and also by the reduction in the grazing area caused by recent changes in the course of the Ganges. The *tarai* probably yields on the whole a surplus of young stock; the upland tracts obtain a few superior cattle from the Punjab, and the bulk of the imported working stock from Gwalior:

purchases are usually made direct from the dealers who visit the district.

Rinderpest has not prevailed recently in this district but foot and mouth disease is common. The attitude towards the practice of inoculation is one of indifference.

Annals.

The district suffered severely in early famines, before the construction of the canals. Apart from them the first regular record of injury dates from 1876 when the condition of the Kali Nadi valley in this and neighbouring districts attracted attention; there had been two years of heavy rain, the water-level had risen, and land had gone out of cultivation. Not much appears to have been done at this time, the drought of 1877 probably mitigating the evil. The district as a whole suffered severely in this drought: the kharif was a very poor crop and some forms of relief had to be continued until the next kharif had been harvested. The district recovered rapidly and by 1883 was prosperous.

After another period of heavy rainfall in 1884—86, general distress became apparent in the *tarai* and central doab tracts, while the great flood on the Kali Nadi in 1885 caused serious injury to the land in the valley. Outside the valley, the deterioration was attributed to what was locally termed "gharki" or over-saturation of the soil, following on the succession of wet seasons, and presented the usual features. The people gradually gave up cropping the weak land and *kans* grass extended rapidly. Parts only of the *tarai* were affected, but in the central doab depression was general, and large reductions of revenue became necessary. Extensive drainage works were undertaken at the same time, in particular the clearing of the Burhganga channel. The extent of the deterioration may be learned from the fact that in 1890 the cultivated area of the *tarai*, the central doab and the Kali Nadi valley had fallen respectively by 34, 36 and 31

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per cent. below the standard of 1873 settlement. The wet seasons ended in 1894-5 and a steady improvement set in, broken temporarily by famine of 1896.

Etah was then classed as a scarcity district, but in both seasons the yield of the crops exceeded eight annas, and though the rabi area fell off, the fall was not large nor was distress serious. In 1899 some villages in Jalesar bordering on the Muttra district and not protected by the canal, were found to suffer from the drought. Extension of the canal was recommended, and the supply was shortly after extended to 12 of the dry villages, while others will be supplied by the Hathras branch. The rest of the district escaped injury in that year and succeeding harvests up to 1910 were on the whole favourable.

The seasonal yields since 1903 are given in the following table :—

Year.	Rabi.				Kharif.			
	All crops.	Wheat.	Barley.	Gram.	All crops.	Maize.	Bajra.	Cotton.
1903 ...	(*a*)	88	81	75	(*a*)	81	75	75
1904 ...	87	87	81	75	75	62	81	78
1905 ...	77	75	75	81	(*a*)	50	75	87
1906 ...	95	100	100	81	86	81	94	100
1907 ...	86	75	100	100	48	50	50	50
1908 ...	84	81	94	81	89	100	100	50
1909 ...	94	87	100	100	94	100	100	75
1910 ...	110	113	113	100	86	94	87	50
1911 ...	106	100	119	106	...	...	...	...

(*a*) Area figures not available.

In 1903 the unirrigated rabi suffered from the absence of winter rains, and the kharif crops, especially millets and cotton, were injured by heavy falls in October. The rains of 1904 were irregular: heavy falls in July and August injured the maize crop seriously, and other crops suffered from

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drought in September and rain in October. The exceptional frost of February 1905 caused substantial loss to cereals and also to oilseeds, *arhar* and garden crops; the following rains were seriously deficient until September, and the dry tract in Jalesar suffered severely. The area statistics, which had been interrupted for some years by survey and settlement operations, were now complete, and showed that cultivation had fully recovered.

The rains of 1906 were such as to raise hopes of a very fine kharif, but excessive rain and wind in September reduced the value of the millets. The rabi of 1907 was good, except for wheat which was affected by rust. The rains of this year were a month late in beginning and ceased at the end of August. All crops were seriously injured, and there was practically complete failure in the dry tract of Jalesar. The rabi area of 1908 was reduced in consequence of drought especially in the central doab, where there were complaints of inadequate supply in the canal, but the yield was on the whole satisfactory. During these seasons distress in the district was very slight, and direct measures were limited to a small amount of gratuitous relief given between January and May, and a single relief work in Jalesar which failed to attract workers in any numbers.

The kharif yield of 1908 was good except in the case of cotton, which suffered first from excess and then from defect of rain; but September was somewhat dry so that in many places irrigation was required before tillage, while a widespread outbreak of malaria in the autumn interfered with field work. The rabi area of 1909 was therefore again low but the yield was good. The kharif of 1909 was also on the whole good, but cotton suffered from stormy weather in September. The *tarai* was flooded in July and August, and there was considerable diluvion on the Ganges. The rabi of 1910 was practically a full area, and it gave an excellent

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yield; the kharif too was good, and would have been exceptionally so but for heavy rain in September and October, which damaged especially cotton and juar. The rabi sown for 1911 was a very large area, and its yield again exceptionally good.

Progress.

The cropped area of the district shows a marked increase during the past two decades, and is now somewhat above the area assessed as cultivated in the settlement of 1873 : it must be taken as practically a maximum. Variations in area from season to season are not marked, but the risk of a progressive reduction in wet seasons must be borne in mind. The proportion of remunerative crops is about constant. Indigo, which covered 90,000 acres in 1873, and 23,000 acres as lately as 1893, has almost disappeared; and the wheat area has not expanded with the increase of cultivation though it is well maintained. Sugarcane is constant, while cotton is again extending after having fallen substantially. Among minor crops, tobacco, potatoes and vegetables are becoming of some importance. The chief change among food-grains is the extension of maize.

The practice of sowing certain kharif crops with the aid of canal-irrigation has made substantial progress, and from $\frac{1}{5}$ to $\frac{1}{6}$ of the area under maize, cotton and fodder, taken together, is now sown in this way, while the proportion rose to $\frac{2}{5}$ths in 1910 when the rains were delayed.

There have been no large extensions of the canal-system during the last two decades, but minor improvements have been carried out and the system will be nearly complete when the west of Jalesar and parts of Azamnagar are supplied. The most important works carried out during this period have been the drainage schemes in the *tarai* and central doab tracts. Construction of masonry wells has of late proceeded steadily, the number increasing by about 500 in each of

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the last four years; and there is now one such well to 42 acres of normal cultivation.

The population of the district fell off substantially between 1881 and 1891 owing to the depression caused by water-logging in the north of the district. The 1901 census showed a remarkable rise of 23 per cent. the two northern tahsils having increased by as much as one-third. A further small increase was recorded in 1911. Agricultural wages have risen in the last five years, and the ordinary rates paid in 1911 were usually in excess of two annas.

Government loans for land improvements (mainly masonry wells) were taken on a small scale for about five years after the drought of 1896. They were then almost discontinued, but in 1907-8 1⅔ lakh were advanced for improvements, and an additional lakh has been advanced in the three following years. Other agricultural advances are taken freely in adverse seasons.

A start has been made in agricultural co-operation: in 1911 there were six rural credit societies with 279 members, and a central bank has just been formed to finance these and promote further extensions.

The Cawnpore-Achnera line opened in 1884 traverses the north of the district, and has recently been connected with the railways north of the Ganges; the East Indian Railway is within reach of Jalesar though it does not actually enter the district, but the central and southern parganas are still inadequately served by railways, and for the whole district there is only one station for 192 square miles. The mileage of metalled roads has been increased by one-half in the last 20 years, but is still low in the north-east.

Rental statistics are available since 1904-5 when settlement proceedings were completed. The rents of occupancy tenants at first rose slightly as the result of enhancements, but for the last four years the average rate has been steady

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at Rs. 4·3 per acre. Competition rents have risen from Rs. 4·6 in 1905-6 to Rs. 4·9 in 1910-11.

Rural industries are not very important. Weaving has declined under competition, and the loss of indigo has reduced the amount of seasonal employment; the extraction and refining of saltpetre is however of growing importance, and the sugar-refining industry of Kasganj is understood to be holding its own if not extending. Organised industries are represented only by three ginning and pressing mills.

The district does not derive a large income from external sources, nor is it increasing rapidly: the sums distributed annually by money-order have varied during the last decade between 4½ and seven lakhs, and have increased on the whole by about one lakh, of which a large proportion is known to represent local transactions.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of rice, which however is little grown, and also of bajra which can be sown until nearly the end of August.

The small area under late rice requires wet weather in the second month, and a long break at this period results in a proportionately large reduction.

The area planted with sugarcane is influenced by the weather in early spring, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains. Taking a longer view, the area is affected largely by facilities for marketing, and better railway communications in the centre and south of the district would probably lead to an extension.

2. The yield of maize, the only early dry crop which is grown depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the maize does best.

The late dry crops require the prolongation of the rains to the middle of September or later: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The late rice requires more rain in September than is suitable for the dry crops, and where canal water cannot be given at least one fall in October is desirable for its complete success.

The district depends for its food to an excessive extent on the later crops, and a somewhat higher proportion of maize is desirable as an insurance against a drought in September.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is

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most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. Apart from variations in the rainfall, the chief danger to the kharif crops probably arises from floods in the *tarai* and the Kali Nadi valley; but the area sown in the latter is relatively small. No serious damage from insect-pests has been reported, but it should be watched for, specially in the case of cotton, sugarcane and juar. It is believed that the bollworm (vide Provincial Note, section VI) is present in the district.

4. The rabi area depends largely on the rainfall in September and October: moderate deficiencies are largely made good by irrigation before sowing, but if this period is altogether dry a substantial falling off must be expected. The area in the *tarai* and the Kali Nadi valley may be much reduced if late floods leave the land unfit for sowing.

5. In ordinary seasons, when the seed-bed has been sufficiently moist, the bulk of the rabi can be matured without winter rains; these are however beneficial until about the middle of February, provided the falls are moderate and of short duration. Rain in March or early April is likely to do some harm, while prolonged periods of damp and cloudy weather between January and March must be expected to produce rust on wheat. The loss from this cause may be serious, and its extent may not be fully recognized till the crop is harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall

of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost early in January does little harm except to *arhar* and possibly to potatoes. Frost at the end of the month or early in February may do very great damage to the rabi crops. A severe frost may injure the vitality of the seed-canes, and thus affect both the area and the yield of the next sugarcane crop.

Hailstorms are of little importance until the cereals are beginning to ear: the danger from them increases as the season advances.

The rapeseed crop may suffer severely from the aphis if damp and cloudy weather occurs while the plants are in flower.

The poppy may suffer greatly from damp weather in March.

A watch should be kept for the appearance of the potato-moth (vide Provincial Note, section VI), which may cause very great loss.

7. The area sown with *zaid* crops in ordinary seasons is not large, but it expands considerably in seasons when stocks of food have been reduced.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in parts of Jalesar, but the extension of the canal will make such an occurrence less probable.

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On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the *tarai*, the central tract and the Kali Nadi valley; the collection of revenue will require especial attention in such seasons, and any fall in cultivation should be regarded as a serious symptom, since deterioration may be very rapid while recovery is likely to be slow.

9. Distress requiring some measures of relief must be expected when the rains have ceased at the beginning of September. Hitherto anxiety has been greatest in regard to the dry tract in Jalesar, but the extension of the canal should make a marked difference in this respect. The following measures were taken in 1907-8 when distress was very slight:—

	Rs.
Revenue suspended, kharif	51,000
" " rabi	8,000
Revenue remitted, kharif	70,000
Improvement loans	¾ lakh
Advances for rabi	2⅓ lakhs
Advances for kharif	¼ lakh

Maximum proportion of population relieved 0·1 per cent. in February.

10. The irrigation resources of the district are so great that a general fodder-famine appears to be a most unlikely contingency. Local scarcities may be expected in seasons when the millets are very stunted, but ordinarily the grant of advances to buy fodder should be sufficient.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons juar occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances if required to enable cultivators to replace cattle that have died from this cause.

11. The extension of canal-irrigation in Jalesar will remove the greatest defect in the water-supply of the district; provision for the south and centre of Azamnagar is however still required. Continued facilities should be given for sinking masonry wells, by the ready grant of loans and the maintenance of a boring staff to assist in locating sites. Should a practicable form of percolation-well be devised, arrangements should be made for the construction of a sufficient number to serve as demonstrations in those parts of the central doab where foundation-clay is not met with.

12. There is at present no demand for drainage works, but when wet seasons recur the water-level of the central doab should be carefully watched, and if it begins to rise any obstructed drainage channels should be promptly cleared out; in particular care should be taken that the channel of the Burhganga is kept clear.

13. To minimise losses from cattle disease, attention should be given to securing the prompt reporting of outbreaks under the rules contained in the Land Records Manual, and a sufficient veterinary staff should be maintained to localise outbreaks when they occur.

Any action that may be authorised by Government should be taken *(a)* for the preservation of the grazing land in the *tarai*, *(b)* for the provision of bulls in the same tract.

14. The district is not well supplied with agricultural capital; the need may gradually be met by the extension of the co-operative organisation, but for the present there is a wide field for the *takavi*-system. Improvement loans may be required for some years to come mainly for sinking masonry

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wells. Agricultural loans may be needed in the following circumstances:—

(*a*) *Early cessation of the rains.*—Money will be wanted to a large amount for sowing the rabi, and possibly again for the kharif, while smaller sums may be required in early spring to ensure the planting of sugarcane and the extension of the *zaid* area. Advances for fodder may also be required.

(*b*) *Floods.*—Loans may be needed to sow the rabi in villages where the kharif has been lost.

(*c*) *Cattle disease.*—It is important that cultivators should be in a position to replace their working-cattle by the beginning of the next tillage season. It may also be desirable to offer loans to cow-owners along the Ganges in order to maintain the breeding industry.

(*d*) *Curtailment of the poppy area.*—It may be found desirable to offer advances in villages where the crop has been largely grown to enable cultivators to substitute some other remunerative crop.

15. It may be possible to introduce agricultural improvements requiring associated action through the agency of one or two of the larger estates, while in time the co-operative organisation may develop to serve this purpose.

As regards cropping, there is a wide field for a better cotton when available: better varieties of wheat and sugarcane can probably be found: the extension of maize is desirable, and possibly a better variety can be introduced: and there is need for a leguminous crop sufficiently remunerative to take a place in rotation on the better soils.

Improved tillage-implements should be useful especially in the *tarai;* and should be found valuable in controlling the *baisurai* weed (vide Provincial Note, section VIII), while there is some room for the cheaper forms of labour-saving machinery.

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DISTRICT NOTE.

BAREILLY.

Topography.

THE assessment circles framed at the last revision of settlement, and shown in the pargana handbooks, are topographical, and the district can best be described by reference to them. There are six main tracts, which may be termed the *tarai*, the central tract, the south-eastern *bhur*, the Ram Ganga valley, the Aonla loam and the Aonla *bhur*. The central tract is much the largest, containing more than half the villages of the district.

1. The *tarai* includes circle III in parganas Chaumahla and Richha; circle II in the same parganas is intermediate between the *tarai* and the central tract. In the *tarai* proper the soil is fairly productive, but the climate is unhealthy and it is difficult to get, and to keep, tenants on the land. The cultivated area consequently fluctuates greatly. In the second, or intermediate, circle cultivation does not fluctuate greatly, but the proximity to the *tarai* keeps rents down.

	Number of villages.	
	Circle III.	Circle II.
Richha ...	17	29
Chaumahla ...	45	49
Total ...	62	78

Most of the tract is watered from canals taking off from the rivers that intersect it; there is practically no well-irrigation. The soil is so moist that there is ordinarily little need for rabi irrigation, and water is wanted chiefly for the rice crop, the supply for which depends on the nature of the dams erected across the streams to feed the canals. In order to meet this need, masonry dams have been constructed in many places where earthen dams were formerly used.

The villages along the Dhoura in circle **II** of Richha and Chaumahla, and those along the Bahgul and its minor streams in Richha are liable to much injury from floods in wet seasons.

2. *The central tract* includes the bulk of the district between the *tarai* and the Ram Ganga river. The circles included in it, and the number of villages they contain, are given on the margin.

Pargana.	Circle.	Number of villages.
Chaumahla ...	I	40
Richha ...	I	151
Kabar—whole pargana...		64
Sirswan " " ...		41
Total in tahsil Baheri ...		296
Nawabganj ...	I	30
" ...	II	181
" ...	III	16
" ...	IV	96
" ...	V	12
Total in tahsil Nawabganj. ...		335
Tahsil Mirganj ...	I	30
" " ...	II	114
Total in tahsil Mirganj ...		144
Bareilly suburban ...	III	51
" Jhanda ..	IV	75
" dumat west ...	V	75
Total in tahsil Bareilly ...		201
Faridpur dumat matiyar	III	89
" Ram Ganga dumat.	V	66
Total in tahsil Faridpur. ...		155
Total villages ...		1,131

The soil in this tract is usually fertile loam, passing into clay; but in circle Jhanda of Bareilly clay predominates and much of the land in this circle is poor; while the suburban circle of Bareilly is exceptionally good, including a large area of garden cultivation. A small portion of Nawabganj (circle V) lies low along the Deoha: and the Ram Ganga circle in Faridpur includes, besides upland, that part of the Ram Ganga *khadir* which is not ordinarily flooded. The tract is thus not altogether homogeneous.

The greater part of the tract is adequately protected against drought. In ordinary seasons water is hardly required for rabi and is used only for rice, cane and garden crops. When necessary, it can be obtained from the canals, the streams (which are fed by springs) and from temporary wells. The latter can be dug in the great majority of villages; as

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a rule they cost little to make and last for one season only, but for the time they are efficient. The localities where temporary wells are impossible have been recorded in the well-survey. In most cases they have no foundation-clay so that masonry wells cannot be recommended, at least until a practicable form of percolation-well has been designed. The Jhanda circle in Bareilly has no means of irrigating the rice crop, which is of great importance; this circle thrives best with a heavy monsoon.

Small areas liable to floods or waterlogging are numerous. Individual villages are noted in the handbooks, but most of them come under the following groups :—

(1) A lowlying tract round Richha road station in circle I of Richha.
(2) Villages along the eastern Bahgul in tahsils Baheri, Nawabganj and Faridpur.
(3) Villages along the western Bahgul in Mirganj.
(4) Villages on the Nakatia in Nawabganj and Bareilly.
(5) A few villages on the Kandu in Nawabganj, on the Basit in Mirganj, and on the Goraiya in Faridpur.
(6) Circle V of Nawabganj, lying on the Deoha.
(7) Parts of Mirganj, and of the Ram Ganga circle in Faridpur, which though not exposed to the Ram Ganga floods in ordinary years, may suffer from waterlogging in wet seasons.

3. The *south-eastern* bhur includes the two *bhur* circles of Bareilly and Faridpur. Beginning at the south of Faridpur, the tract is divided into two portions by the dumat-matiyar circle of Faridpur; the eastern branch terminates in Faridpur, while the western continues up to the east side of Bareilly. The tract consists of uneven

Pargana.		Circle.	Number of villages.
Bareilly ...	*Bhur* ...	I	124
	„ ...	II	56
	Dumat, east	VI	13
Total in tahsil Bareilly ...			193
Faridpur ...	*Bhur* west ...	I	138
	„ east ...	II	59
	Deoha, dumat	IV	14
Total in tahsil Faridpur ...			211
Total villages ...			404

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sandy land with stretches of better soil in places; two of these are large enough to be classed as separate circles (the east dumat of Bareilly and the Deoha dumat of Faridpur), and resemble the central tract described above; while most villages have some loam within their borders. The *bhur* is not of the worst type, but much of it goes out of cultivation after a series of wet seasons. The area of coarse grass is small and is regularly cut, so that little loss is caused by wild animals.

Temporary wells can be dug in most places; they last only for one season and sometimes require to be lined with arhar stalks. Irrigation is not essential for the rabi in ordinary years provided there be a light fall of rain in the winter. Even in dry seasons irrigation is practised to a less extent in Faridpur than in other parts of the district, the reason assigned being the backwardness of agriculture in the locality.

Villages on the Goraiya nala in Faridpur suffer from flood; the liability of much of the *bhur* to deteriorate in a series of wet seasons has been mentioned above.

4. *The Ram Ganga valley.*—The circles noted on the margin are formed mainly of the alluvial villages in the bed of the Ram Ganga, though a few alluvial villages on other rivers are also included in them for convenience of assessment. The Ram Ganga villages are liable to loss of the kharif from flood, but the rabi is usually safe and does not require irrigation. With these may be classed the *khadir* circle of tahsil Aonla (containing 9 villages in Sirauli and 11 in Aonla pargana), which lies beyond the alluvial villages and suffers less from flood but is equally independent of irrigation.

Pargana.	Circle.	Number of villages.
Tahsil Mirganj ...	III	26
Bareilly, Alluvial ...	VII	48
Faridpur ,, ...	VI	26
Sirauli (South) alluvial		5
Aonla ,,		5
Suneha ,,		8
Ballia ,,		17
Total in tahsil Aonla		35
Total villages ...		135

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The worst dangers that threaten the alluvial villages are actual diluvion due to frequent changes in the river's course, and floods so late in the season as to interfere with rabi-sowings.

5. *The Aonla loam and clay.*—This tract lies in parganas Aonla, Suneha and Ballia, between the Ram Ganga and the Aonla *bhur*, and includes the circles named Aonla dumat, Aonla matiyar and Aonla jungle. The last is inferior, being cut by numerous small streams and having large areas of dhak jungle; the rest of the tract is productive soil. The water-supply is ample, being drawn mainly from the Aril river and from minor streams; water is close to the surface, and wells can be dug very cheaply. They are little used in ordinary years, as the streams suffice, but are of the utmost importance in a drought. The dams on the Aril are managed by the landholders, and disputes occasionally arise which interfere with the efficiency of the system; but of late years there have been few complaints. The northern portion of the tract is exposed to injury from the heavier floods of the Ram Ganga which damage the kharif crops.

Pargana.		Circle.	Number of villages.
Aonla ...	Dumat ...	I	37
	Jungle ...	III	25
Suneha ...	Dumat ...	I	66
	Matiyar ...	II	53
Ballia ...	Dumat ...	I	27
	Matiyar ...	II	7
Total villages ...			215

6. The *Aonla bhur* lies in parganas Aonla and Sirauli, and includes the two circles bearing that name and forming the south-west corner of the district; the second circle is inferior to the first. The tract is usually irrigable from small temporary wells worked by *charkhi*, which fall in within a year and as a rule are dug only when the rains fail; in a few places spring-wells are possible which last several years and are worked by bullocks.

Pargana.		Circle.	Number of villages.
Sirauli ...	*Bhur* ...	I	33
		II	14
Aonla ...	,, ...	II	47
Total villages ...			94

The first circle is for the most part adequately drained, but the second contains some waterlogged-land along the Aril river.

Water-supply.

The water-supply of each tract has been noticed above; for the district as a whole temporary wells are the great resource. The distribution of foundation-clay is very irregular, and in most villages it would be unwise to attempt a masonry well without trial borings. Nearly half the masonry wells of the district are situated in Bareilly tahsil where foundation-clay is perhaps less uncommon than elsewhere: there does not appear to be any hostility on the part of landholders, but the need for irrigation is so slight that the temporary well is economically justified. The weakness of the canal system is its dependance on local rainfall, so that supplies are likely to fail when most needed. This defect would be largely removed if the Sarda-Ganges canal were constructed as it would supplement the local supplies.

Cattle-supply.

The stock of cows in the district is relatively very low. Such grazing as the Ram Ganga valley affords is mainly occupied by buffaloes kept for dairy purposes. Only in the north of tahsil Baheri is there anything in the way of regular breeding. Here the individual herds are not large, but the combined herds, which are taken to graze in the *tarai*, make up a substantial number of cows. There is a great want of suitable bulls in this tract, and it is said by owners that more cows would be kept if bulls were made available.

Western plough-cattle are brought into the district in small numbers by the itinerant dealers, but the imports consist mainly of cattle from Bijnor and Pilibhit.

The district is liable to all the common forms of cattle-disease. The people are still indifferent to the practice of inoculation: the smallness of the local veterinary staff has prevented much action being taken in this direction.

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Annals.

Reports on the district have been received since 1895, but with few exceptions the earlier reports dealt with the effect of the Ram Ganga floods; with disputes regarding bunds on the rivers; and with minor defects in the drainage, which have been remedied. The failure of the rains in 1896 led to the entire loss of the late rice, and to a reduced rabi area for 1897; gratuitous relief was given from November to September, while relief-works were opened from January to June, but the distress was not very serious. In 1899 the rains ceased in August and the late rice was again almost destroyed, but no other serious calamity was reported up to 1902.

The seasonal yields since 1903 are given in the following table :—

Year.	Rabi.				Kharif.			
	All crops.	Wheat.	Barley.	Gram.	All crops.	Rice.	*Bajra.*	Sugarcane.
1903 ...	80	81	85	81	80	81	75	81
1904 ...	84	87	85	81	87	87	87	100
1905 ...	87	87	95	94	81	75	87	75
1906 ...	75	75	80	69	103	106	100	100
1907 ...	67	50	75	87	41	25	50	30
1908 ...	72	81	81	60	94	87	100	75
1909 ...	81	81	81	81	87	87	87	81
1910 ...	100	100	100	100	85	75	81	94
1911 ...	83	75	94	87	...	...	...	...

The rabi of 1903 suffered from the absence of winter-rains, and the following kharif from drought in July and excessive rains in October. The year 1904 was prosperous, and the cane-crop was particularly good. The exceptional frost of 1905 was felt in this district as elsewhere, but the staple crops were too backward to be seriously affected;

arhar and garden-crops however suffered greatly and the seed-canes were injured. Rust appeared on wheat and linseed. The rains of this year were late and scanty, but a heavy fall at the end of September secured fair crops. The rabi area of 1906 was somewhat contracted owing to drought, and the crops suffered from want of moisture. The following rains were however favourable throughout. The rabi crops of 1907 suffered from excessive rain, which led to severe rust on wheat; they were also affected locally by hail and by rains at harvest-time.

The rains of 1907 fell between 23rd July and 29th August. Good crops were obtained in the lowlands, and maize did well in many places, but all the late crops suffered severely and sugarcane yielded very badly. The rabi area of 1908 was much contracted, and the crops, especially gram, suffered from deficient moisture at the start: but the later winter-rains were favourable, and owing to rain in the *tarai* the canals gave a better supply than was anticipated. Gratuitous relief was given from January to June and aided works were open for the greater part of this period, but distress was at no time serious.

In 1908 the rains were sufficient to secure good crops, but sugarcane had suffered from the early drought and both it and late rice were affected by drought in September. The same cause, together with the severe epidemic of malaria, kept the rabi area of 1909 very low: the crops suffered at first from lack of moisture, while heavy rain in April did substantial damage on the threshing-floors. Foot and mouth disease was very prevalent during the spring and interfered with field work. The rains of 1909 were at first heavy, and there were floods on the Ram Ganga and Bahgul: in August and September the falls were insufficient for late rice and sugarcane. It was however possible to sow nearly a full rabi area for 1910, and the crops were good. The rains of this year were

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satisfactory until the end of the season when they were excessive. There were serious floods in the lowlands, but it was found possible to sow these for the following rabi, and the largest area recorded since 1895 was cropped. The season was too wet for wheat, which suffered somewhat severely from rust.

Progress.

There has been a slight extension of cropping in the last two decades, and with the exception of the *tarai* tract the district is now so fully cultivated that no further expansion can be expected. The rabi area is subjected to considerable fluctuation according to the nature of the sowing-season. The proportion of remunerative crops has increased substantially during this period, and is fairly high. The area under sugar-cane varies considerably but is on the whole less than it was: but there has been a large expansion in the case of wheat and to a less degree of cotton, while potatoes and garden crops have increased substantially. The area under poppy was extending but is now being reduced.

There has been steady improvement in the canal-system; several dams and new channels have been constructed to make the best use of the supplies of water that are available and pargana Sarsawan has benefited in particular: but in the other parganas commanded the area irrigated in dry seasons has not risen materially. The supply of water is the limiting factor and until this is increased by the Sarda-Ganges canal, much progress cannot be expected. The number of masonry wells has almost doubled between 1905 and 1911, but even now there is only one such well to 561 acres of normal cultivation, and this source of supply is important in a few localities only. Perhaps the greatest advance made in this period is the realisation of the capacities of the district in a drought if capital is provided in time.

The population of the district increased substantially between 1891 and 1901, but only a trifling rise occurred in the last decade, and in 1911 it was 1,095,000 against 1,041,000 in 1891.

Agricultural wages have risen in the last five years: the lowest rates have not changed, but higher rates have appeared in places. In 1911 the rates varied from 2¼ to 3¼ annas.

In this district there is comparatively little scope for land improvement owing to the difficulty in making masonry wells, and loans for such purposes are taken only to a very small extent or in exceptional seasons. Loans for cultivation are taken freely when the need arises, and the amount of these has increased greatly, not merely in 1908, but in the years that have followed. Agricultural co-operation has made a promising start: in 1911 there were 17 rural credit societies with 408 members and a working capital of Rs. 32,000, but a rapid expansion has occurred since these figures were compiled, two central banks and many rural societies having recently been registered.

The railway system has been extended during the last twenty years by the opening of the lines to Moradabad and Kasganj, and there is now one station to 69 square miles. There has been no extension of metalled roads and the north and east of the district need more unmetalled roads, and particularly bridges, as these tracts consist of long narrow doabs.

The settlement completed in 1902 resulted in an average rise of 8 annas per acre in the rents of recorded occupancy tenants, and there has been no appreciable rise in the last eight years, the average rate being still Rs. 4·5. Other cash rents have risen in the same period from Rs. 5·1 to Rs. 6·1.

Among industries sugar-refining has somewhat declined under competition but is still of great importance; textiles have also declined and some seasonal employment has been lost by the disappearance of indigo. The woodwork industries of the city have progressed and the manufacture of furniture

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promises to develop further. Organised industries are represented only by the small railway workshops.

The district does not apparently derive a large income from external sources. Distribution of money-orders has risen in the last decade from about eight to twelve lakhs, but a large proportion of this is understood to remain in the city.

Dangers and possible remedies or improvements,

1. The area sown with kharif crops, of which maize is much the most important, depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be reduced, but more rice will be sown and there may be an extension of *bajra* which can be sown until nearly the end of August.

The small area under late rice depends on the weather of the second month : frequent falls of rain with little sunshine are required, and a long break at this period will lead to a reduction in the area.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage : but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons ; another is the view of the future taken by the sugar manufacturers who under the system of advances in vogue have a large influence in determining the area under the crop.

The area sown with cotton is affected to some extent by the nature of the sowing season ; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains.

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2. The yield of the early dry crops depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more and later rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains to about the middle of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The small area under late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

The balance of cropping is such as to ensure a supply of food in most seasons; a considerable proportion of the food-crops are safe by the end of August, while *bajra* can often yield well when the early crops have been bad.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. Apart from variations in the rainfall the chief danger to the kharif is from floods in the Ram Ganga valley and in the other areas enumerated in the section dealing with topography.

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Severe injury from insect-pests has not been recorded but should be watched for, especially in the case of sugarcane and cotton.

4. The rabi area depends mainly on the rainfall of September and early October, and may fall seriously if the rains cease early. In the Ram Ganga valley the area may fall if late floods leave the land too wet for tillage.

5. Winter rains are most desirable in all seasons for the success of the rabi. Ordinarily falls are beneficial until February, provided they are moderate and of short duration. Late rain may cause some injury, while prolonged periods of damp and cloudy weather between January and March must be expected to produce rust on wheat and linseed. The loss in this case may be very serious, and its extent may not be fully realised till the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter-rains is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frosts occurring early in January do little harm except to potatoes and *arhar*, and judging by the experience of 1905, they are not dangerous up to the first days of February: but a still later frost might produce very serious loss to the rabi. There is however danger of injury to the seed-canes from severe frost in January.

Hailstorms early in the season are of little importance. The danger from them increases as the season advances.

The rapeseed crop may suffer severely from the aphis if damp and cloudy weather occurs while the plants are in flower.

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The poppy crop may be severely injured by damp and cloudy weather at the end of the season.

The potato-moth (vide Provincial Note, section VI) is a serious danger to this crop, and its appearance should be watched for in order that early action may be taken.

Field-rats occasionally cause substantial injury to the rabi in the lighter soils: their numbers increase after a season of light rainfall, and a single wet season appears to reduce them considerably.

7. The area sown with *zaid* crops in ordinary seasons is not large, but it extends considerably when stocks of food have been reduced.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the *bhur* tracts, and also probably in the *tarai* where the climate will deteriorate.

9. Distress requiring some measures of relief must be expected when the rains cease by the beginning of September. There is no recent experience to show where its incidence is likely to be greatest. In 1907-8 when distress was slight the following measures were taken :—

Revenue suspended, kharif	4 lakhs.
„ „ rabi	½ lakh
„ remitted, kharif	¼ „
„ „ rabi	⅓ „
Improvement loans	¼ „
Advances for rabi	4⅔ lakhs
„ „ kharif	⅔ lakh.

Maximum proportion of population relieved 0·8 per cent in March

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10. It is possible that a serious shortage of fodder may occur in parts of the south of the district in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter-rains: if there are none, it may become important, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons *juar* occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. There is not much to be done in present circumstances in order to improve the water-supply. Loans for masonry wells should be given when required, and a boring staff should be provided to assist persons who are uncertain if the site is suitable.

Should a practicable form of percolation well be devised, arrangements should be made for the construction of a sufficient number to serve as demonstrations.

There may be scope for pumping-installations on the smaller rivers.

12. There is at present no demand for drainage-works, and a demand is not likely to arise except for small local depressions.

13. To minimise losses from cattle disease it is most desirable to enforce steadily the system of reporting outbreaks prescribed in the Land Records Manual, and to maintain a sufficient veterinary staff to localise outbreaks when they occur.

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The preservation of the *tarai* pastures on which the district-breeders rely is probably assured. The supply of bulls in the north of the district requires to be increased, and action should be taken in accordance with any orders that Government may issue.

14. Cultivators are not adequately equipped with agricultural capital, and the important supplies which they obtain from sugar-manufacturers are as a rule too dearly purchased. There are signs that the need may be gradually met by the expansion of the co-operative organisation, but for the present there is a considerable field for the employment of the *takavi*-system. Improvement loans are not likely to be in much demand, but should be given when required for wells or other appropriate works. Agricultural loans may be required in the following circumstances:—

(*a*) *Early cessation of the rains.*—There is likely to be a very large demand for sowing the rabi, and a further demand on a smaller scale for the following kharif, while money may be wanted about February to sow *zaid* crops, and to plant sugar-cane where cultivators are not financed by the manufacturer.

(*b*) *Floods.*—Advances may be needed in the areas affected to enable the people to sow rabi.

(*c*) *Cattle-disease.*—It is important that cultivators should be in a position to replace working-stock by the beginning of the next tillage-season. In order to maintain the supply of plough-cattle it may also be desirable to give advances to cow-owners to enable them to replenish their herds.

(*d*) *Curtailment of the poppy crop.*—It may be desirable to offer advances in villages where the crop has been largely grown, to enable cultivators to substitute some other remunerative crop.

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15. The co-operative organisation offers, or will shortly offer, an agency for the introduction of agricultural improvements requiring associated action. The cropping of the district requires examination before definite suggestion can be made for its improvement: but probably better varieties of sugarcane can be found at least for some localities. There should be scope for the cheaper forms of improved implements and machinery, and particularly for better tillage-implements in the Ram Ganga *khadir*: and efforts should be devoted specially to introducing improved sugarcane-mills, as those in use are as a rule very inefficient.

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DISTRICT NOTE.

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Topography.

THE district may be divided into the following agricultural regions.

The Ganges khadir.—This tract occupies the west of the district in parganas Najibabad, Mandawar, Bijnor, Daranagar and Bashta, and includes the lowlands along the river Malin which joins the Ganges in Mandawar. The *khadir*, which varies greatly in width, usually lies in two levels; on the lower level along the river the cultivation depends entirely on accidents of season and fluctuations of the direction of the current; but the upper *khadir* lies high enough to be protected from ordinary floods, and except in parts of Mandawar and Bashta is fertile and closely cultivated, though liable to over-saturation in wet seasons.

The western uplands.—This tract runs parallel to the *khadir*, passing through the parganas already named as well as Chandpur. It consists of sandy ridges separated by broad plains; the plains consist of a light loam and are fairly fertile, but the ridges are inferior sand and require long periodical fallows. The population of this tract is scanty, the water-level is low, and successful cultivation depends entirely on favourable seasons.

The central uplands.—This tract lies parallel to the western uplands. It is a broad belt of country lower than the sandy belt on the west; the soil is mainly good loam with little sand, but there are in places stretches of stiff clay. Part of the tract is watered by the Khoh and Gangan canals, and temporary wells can be dug with ease when required. Drainage is usually sufficient, but occasionally in wet seasons the river Ban cannot carry off the whole drainage that flows to it, and the land along it is flooded.

The eastern uplands.—Further east again is a narrow belt running through Nagina, Dhampur and Seohara; this is more elevated and more sandy than the central uplands, but the soil is fertile and there is a large population.

The Ram Ganga and Khoh khadir.—These rivers which unite in the district flow through or bound Barhapura, Nagina, Dhampur, Sheohara and Afzalgarh. Apart from the land immediately on the river bank, this *khadir*, like that of the Ganges, is fertile and fairly secure against ordinary floods, but in the southern pargana of Afzalgarh, the capricious course of the river and proximity to the forest interfere with cultivation.

Afzalgarh tract.—This includes the portion of Afzalgarh between the Ram Ganga and the forest. It is of *tarai* type with light but productive soil; it is very unhealthy, both for men and cattle, and particularly in wet years.

Forest tract.—Finally there is a belt of forest, from two to ten miles broad, along the north-eastern border of the district. This tract is not homogeneous. In the extreme north there are hills of the Siwalik type, and in the extreme south-east the conditions approximate to those of the Bhabar and Tarai. Between these limits the tract is of the Bhabar type, but narrower and with a gentler slope so that there is a greater depth of soil above the bed of boulders. The extreme north and the south-east are government forests: the rest is privately owned and constitutes a most important grazing-ground: but most of the soil is cultivable, and cultivation has in places penetrated to the boundary of the district. The tract is very unhealthy and the population is scanty: while the crops suffer severely from the ravages of wild animals.

Water-supply.

The canal system is practically confined to parts of the central uplands in Nagina, Dhampur and Seohara. It makes the most of the existing water-supply, but this is not altogether assured in severe drought.

Masonry wells are very rare: foundation-clay is not met with except in places in the south of the district (chiefly in Burhpur and Seohara), and where it is not found the central parts of the district depend on temporary percolation-wells, which are easily made except in the sandy areas. Streams or *jhils* are used extensively in Najibabad and Afzalgarh, and also in Nagina and Seohara.

There is probably room for more masonry wells in the south of the district, where foundation-clay is met with: elsewhere the grant of advances when required for temporary wells or dams must be the chief measure of protection.

Drainage.

The drainage of the district is as a rule satisfactory: the exceptions are (1) the lowlands along the Ban in the central upland, (2) the *khadir* tracts. The Afzalgarh tract is liable to much deterioration in a series of wet years: it is not clear how far this is due to over-saturation of the soil and how far to increase of sickness, but the two causes are probably the same, depending on a rise in the water-level.

Cattle-supply.

The stock of cows kept in the district is proportionately very large, and the quality is superior though it cannot be classed as a distinct breed; it is localized (1) along the edge of the forest tract, and (2) along the Ganges and Ram Ganga rivers. In parganas Afzalgarh and Barhapura there are several large herds: the owners of these either own or have obtained possession of suitable grazing-grounds in the forest tract, and are very careful in the selection and maintenance of the herd-bulls. The small owners in these parganas, and also in Najibabad, where there are apparently no large herds, graze their cows in the forests: bulls set aside for breeding are very rare, and the mating is promiscuous. The cows along the rivers are grazed in the lowlands, and here too suitable bulls are very scarce.

The young stock is sold to dealers, mainly *banjaras*, who distribute it over the district and also export eastwards. There is also some import of superior animals from the Punjab.

The district is liable to all the common forms of cattle-disease: the practice of inoculation is now welcomed by the people generally.

Annals.

The district suffered severely in the famines of 1803, 1837, 1860, 1868 and 1877. After the latter year there is no record of adverse circumstances until about 1894, when a series of wet seasons resulted in over-saturation in the Ganges *khadir*, and general depression in the Afzalgarh tract. The *khadir* suffered further in 1895 by the desertion of cultivators in anticipation of flood from the bursting of the Gohna lake in Garhwal. The uplands, especially the western tracts, were distressed as the result of the drought of 1896, following on very poor crops in the previous year. Relief works were required only from December to March, but gratuitous relief was continued to October. In 1898 the *khadir* in pargana Bashta was depressed, and Chandpur was still suffering from the effects of the previous year's drought. There was little or no recovery in these tracts in 1898-99; while the early cessation of the rains of 1899 injured the *kharif* all over the district, and in particular the cane crop. The rabi area of 1900 was contracted owing to the same cause, and the crops were not good: the loss was greatest in the western uplands where there are no means of irrigation. There was severe cattle disease in many villages, and on the whole the district

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was depressed. The rains of 1900 however were favourable and made good the losses of the previous year. Some villages in the Afzalgarh tract were however found to be still seriously depressed, as the cultivators had died or migrated. The rains of 1901 ceased early and all crops, but especially sugarcane, suffered, while the rabi area of 1902 was reduced. There was practically no winter rain and the yield was poor. The depression in Afzalgarh was found to be widespread, and to extend into Barhapura, and proposals for reducing the revenue were submitted. The rains of 1902 were favourable.

The seasonal yields since 1903 are given in the following table :—

Year.	Rabi.			Kharif.			
	All crops.	Wheat.	Barley.	All crops.	Rice.	*Bajra.*	Sugarcane.
1903	78	78	88	89	87	94	69
1904	95	87	94	87	81	87	87
1905	85	87	94	73	62	81	80
1906	80	81	81	97	113	87	94
1907	92	94	94	22	13	31	50
1908	75	75	75	84	81	94	70
1909	81	81	81	95	94	100	100
1910	102	105	102	81	81	69	94
1911	92	87	100	...	...	...	...

The rabi of 1903 suffered from want of rain and from strong winds. The rains of this year began only on 19th July, and the sugarcane suffered severely from heat and drought, but the rest of the season was favourable, and a very large rabi area was sown for 1904. The report for this year noticed the development of ravines owing to the clearance of parts of the forest tract. The rains of 1904 were on the whole favourable though insufficient for rice, and they lasted long enough to secure another large rabi area for 1905. This crop was very little affected by the exceptional frosts of

February, but excessive rain injured the wheat (probably by inducing the spread of rust). The report for this year noticed the improvement of the Afzalgarh tract, which has continued until 1911.

The rains of 1905 were late and inadequate; all crops, especially rice, suffered; and the rabi of 1906 was reduced in area, and was somewhat affected by the dryness of the seed-bed. The following rains were satisfactory and enabled a full area to be sown for 1907. These seasons were therefore prosperous, but losses from cattle-disease were serious in many villages. The rains of 1907 began very late, but a large kharif area was sown: outside the *khadirs* it suffered very severely from the cessation of the rains at the end of August. The rabi of 1908 was about one-third below the normal in area, and suffered first from lack of moisture and then from dry west winds. There was some distress during these seasons: gratuitous relief was given from December to June, and a small amount of employment was afforded on aided-works: but there was never any cause for anxiety after rain fell in January. The report for this year noticed the great improvement of the Ganges *khadir* in pargana Bashta.

The rains of 1908 were favourable until September when they were in defect; the sugarcane had already suffered from want of moisture in the hot weather, and was a poor crop. Rabi sowings for 1909 were contracted by drought and sickness, and the crops suffered from drought in the early stages. The following rains were however good, and sugarcane in particular benefited by their prolongation from 15th June to October. A full rabi area was sown for 1910 and yielded exceptionally well. The rains of this year were scanty in July and excessive for the rest of the season. Sugarcane again did well, but *bajra* was seriously affected by the late rain, while rice suffered from the early drought. The rabi area of 1911 was exceptionally large, and was again successful;

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but wheat was affected by rust following on the damp weather of February and March.

Progress.

The area under crops has extended substantially in the last two decades. The increase is accounted for in part by the improvement in the condition of Afzalgarh and the Ganges *khadir*, and in part by cultivation in the forest tract. The advantage of this last change is problematical: grazing-grounds have been reduced, and as noticed above there has been some extension of ravines, which may be found to be progressive. The area sown fluctuates considerably with the nature of the seasons.

The proportion of the area sown with remunerative crops is high and tending to increase. Sugarcane fluctuates from year to year but on the whole there has been a slight extension: cotton is increasing in popularity and wheat shows a steady expansion.

In regard to irrigation the district stands much where it did twenty years ago. The canals have been largely remodelled so as to make better use of the available supply, but no large areas have been supplied in the interval. There are less than 1,000 irrigation wells available in the whole district, and this number is increasing only by about 20 annually.

Population fell slightly between 1891 and 1901 but has recovered in the last decade; in 1911 it stood at 806,000 as against 794,000 in 1891.

Agricultural wages are relatively high but have not moved much in the last five years: in 1911 the ordinary rates lay between 2½ and 3 annas, but harvest-wages are considerably higher.

Advances for land improvement have been practically unknown in ordinary years, but apparently a slight tendency to take them is springing up. Apart from wells in the south of the district, there is comparatively little scope for them. Advances for temporary purposes are not taken in

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ordinary years: but they are very greatly needed in years of drought. Agricultural co-operation has made a start: in 1911 there were 12 rural credit societies with 228 members, and an early extension is anticipated.

The only developments in the railway system during the last twenty years have been the opening of (1) the line from Najibabad to Kotdwara, and (2) the branch from Chandpur to join the Moradabad-Delhi line: in 1911 there was one railway station to 149 square miles of area. There is a strong local feeling in favour of extending the line from Chandpur through Bijnor to Najibabad, but this has recently been refused. Metalled roads are also deficient: the absence of *kankar* from the district makes the maintenance of these expensive, while the unmetalled roads are often very heavy. A programme of improvement is being gradually carried out, but it should not be regarded as in any way exhaustive.

Occupancy rents have not changed since 1899-1900, the first year in which records were prepared after settlement; the returns give an average rate of Rs. 5·6 an acre. In the same period, competition rents have risen from Rs. 6·0 to Rs. 6·9 per acre, the rate of increase being less than on the west of the Ganges.

The chief rural industries are weaving and sugar refining: both have suffered from competition. The carving and other crafts of Nagina have developed their business in recent years. Organised industries are represented only by a ginning mill.

The sums distributed by money-order have risen in the last decade from about 10 to nearly 16 lakhs: the sources of this income have not been ascertained.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be

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bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of rice, and also of *bajra*, which can be sown until nearly the end of August. The area under late rice is now unimportant.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains. Taking a longer view, the area is affected largely by facilities by marketing, and would probably extend if communications are improved and additional gins and presses established.

2. The yield of the early dry crops depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more and later rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains to about the middle of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an

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early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

The district is rather too much dependent for its food-supplies on the prolongation of the rains, and the extension of maize would probably be an improvement from this point of view.

3. Apart from variations in the rainfall, there are apparently few dangers to the kharif crops. The loss from flooding in the lowlands is not usually important: no serious injuries from insect-pests have been reported.

4. The rabi area depends mainly on the rainfall in September and early October: it may fall very seriously if the rains cease early, while rain in October secures a considerable excess over the normal. The area in the lowlands may be reduced in exceptional years when late floods leave the land too wet for sowing.

5. Winter rains are important in all years for the success of the rabi crops. They are useful as late as February, provided the falls are moderate and of short duration: falls at the end of the season are injurious, and prolonged periods of damp and cloudy weather between January and March must be expected to result in the spread of rust on wheat and linseed. The loss from this cause may be very serious, and its extent may not be fully realised until the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall

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of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals.

6. Frosts are expected in early January and do little harm to the rabi: the frost in the opening days of February 1905 was not seriously felt, and apparently severe injury need not be anticipated unless frost should occur towards the middle of that month. There is always a risk that late frost may injure the sugarcanes kept for planting.

Hailstorms are of little importance early in the season, but the risk of loss increases as the season advances from February onwards.

The rapeseed crop may be seriously injured by the aphis if damp and cloudy weather occurs while the plants are in flower.

Reports of injury from white ants are usually received when the rabi seed-bed has been dry, but the possible extent of the injury has not been clearly ascertained.

7. The area sown with *zaid* crops in ordinary seasons is very small, and does not increase appreciably in years when stocks of food are low.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the two *khadirs* and in Afzalgarh; any fall of cultivation in the latter tract should receive early attention with a view to reducing the revenue temporarily if the circumstances require it.

Another process which may produce cumulative results is the increase of wild animals in the forests; and if complaints of injury increase, an endeavour should be made in conjunction with the forest department to restore the balance of animal life.

9. Some measures of relief will probably be required when the rains cease before the beginning of September: it is not probable that distress will be severe unless the kharif crops should be almost entirely lost.

The following measures were taken in 1907-8:—

Revenue suspended, kharif	2 lakhs.
,, ,, rabi	⅓ lakh.
Revenue remitted, kharif	1¼ ,,
,, ,, rabi	¾ ,,
Improvement loans	¼ ,,
Advances for rabi	1⅔ ,,
,, ,, kharif	1¾ ,,
,, ,, sugarcane	⅓ ,,

Maximum proportion of population relieved 0·3 per cent. in March.

10. Experience is wanting of conditions which would produce a severe fodder-famine, and the contingency is apparently most unlikely. Should it occur, importation of grass from the Tarai and Pilibhit forests may be practicable.

11. No extensive measures can be suggested for the improvement of the water-supply, but loans should be granted to any persons who require money to make masonry wells. Should a suitable percolation-well be devised arrangements should be made to sink a sufficient number to serve as demonstrations.

12. There appears to be need for drainage works.

13. To minimise losses from cattle-disease, attention should be steadily given to enforcing the system of reporting outbreaks prescribed in the Land Records Manual, and the

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veterinary staff should be sufficient to localise outbreaks as they occur.

The question of preserving the private forests along the north of the district as grazing-grounds for cattle is of great importance, and action should be taken on the issue of any orders on the subject.

14. The district is relatively well supplied with agricultural capital, and there is not much scope for *takavi* in ordinary years. Advances should however be made readily available after an early cessation of the rains as it is of the utmost importance to maintain the rabi area, and no cultivator should be prevented by lack of funds from digging the wells he requires.

15. There is at present no organisation to introduce agricultural improvements requiring associated action, but the co-operative organisation may develop so as to serve this purpose. The cropping of the district requires examination before suggestions can be made for its improvement, but probably both sugarcane and cotton can be improved. Wages have risen to a point where labour-saving machinery is beginning to be appreciated, and the district requires special attention in this direction.

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DISTRICT NOTE.

BUDAUN.

Topography.

THE district is naturally divided into four well-defined tracts, the *katehr* along the north, the *bhur* ridge in the centre, the Ganges *khadir*, and the eastern lowlands.

The katehr.—The soil is fertile loam with clay in the depressions, and is well cultivated: with good rains it does not need irrigation; but, if necessary, temporary wells can be dug almost everywhere at the cost of a very few rupees. When, therefore, the autumn rains fail, a large proportion of the rabi can be secured by immediate distribution of advances for wells.

The following exceptions to this general description are noteworthy:—

(*a*) In pargana Usehat this fertile tract narrows and eventually disappears as the Ram Ganga approaches the Ganges; the soil is here known as *katil* and is inferior to the regular *katehr*, being lighter and less cohesive. Temporary wells do not hold and in most places cannot be dug at all. Parts of this tract must, therefore, suffer in years of drought. The tract comprises 81 villages classed as the *dumat* circle of the pargana.

(*b*) There are a few scattered villages where the soil is sandy and dry, which are detailed in the second statistical appendix of the pargana hand-books. The numbers are shown on the margin.

Pargana.	Number of villages.	Area in acres.
Bisauli ...	8	1,481
Islamnagar	6	2,477
Satasi ...	4	1,009

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Subject to these exceptions, the *katehr* is secure against drought. Parts of it were, however, affected by floods during the run of wet seasons ending in 1894, and villages along the rivers are subject to periodical ravining and to flooding of the lowlands. The general effect of flooding was felt most in parganas Kot and Islamnagar. In Kot the slope of the land is too small to carry off the surface drainage with sufficient raipidity in years of heavy rainfall: the autumn crops may thus be injured and the winter sowings delayed. In Islamnagar the injury was attributed by the settlement officer to the flood water coming from the centre of the Sambhal pargana in Moradabad, a tract which has no regular drainage system of its own. In these parganas there have been no complaints since the run of wet seasons ended.

The villages affected by the various rivers in the *katehr* are detailed in the appendices to the handbooks. In the uplands there are 41 precarious villages along the Sot, * which enters the district through Islamnagar and flows between Kot and Ujhani on the west and Bisauli, Satasi and Budaun on the east. On entering Usehat it passes into the Ganges *khadir*.

* Pargana.	Number of villages.	Area in acres.
Islamnagar	13	5,987
Kot ...	3	1,307
Bisauli ...	14	7,498
Satasi ...	5	1,988
Budaun ...	1	380
Ujhani ...	5	3,349

The Aril, which flows through the north of Islamnagar and Bisauli, affects 12 villages † in those parganas. It then passes into Bareilly, and where it returns to Budaun its course lies through the eastern lowlands.

† Pargana.	Number of villages.	Area in acres.
Islamnagar	4	1,284
Bisauli ...	8	5,197

The Aswar-Bhainsor rivers injuriously affect in this tract only pargana Kot (11 villages with an area of 9,060 acres).

Finally, there are a few isolated villages * which are from local causes liable to flooding and over-saturation. These also are shown in the appendix to the handbooks.

* Pargana.	Number of villages.	Area in acres.
Kot ...	8	5,745
Islamnagar	2	918
Satasi ...	7	5,162
Ujhani ...	3	1,531
Usehat ...	7	3,875

The bhur.—South of the *katehr* is the *bhur* ridge, the villages in which have in each pargana been grouped as a separate assessment circle. The area occupied by this ridge is 182,937 acres, divided among 275 villages.† The particular features which characterize this tract can best be learnt from the full descriptions printed as appendices in the Asadpur and Sahaswan handbooks. The permanent defects of this soil are the coarseness of its texture, and the impossibility of constructing wells in the sandy sub-soil. Continuous cultivation is practically impossible outside the manured circle, and fallows have sometimes to be given after two or three years' cultivation. When the district was under settlement the north and east slope of this tract was suffering in a marked degree from over-saturation, the result of the succession of wet seasons, which began just after a period of prosperity during which the land had been heavily cropped. Fallows were in any case necessary, and the soil got so sodden as to prevent the full growth of the crops. Cultivation consequently contracted and the *kans* and *sarkara* grasses occupied the vacant land affording shelter to large numbers of pig and deer. The climate also deteriorated; sickness was rife and tenants moved away to the new land which was made available by the retreat of the Ganges. The waterlogging and the unhealthiness are alike attributed to defective drainage. On the south-west of the ridge is a line of depressions known as the

† Pargana.	Number of villages.	Area in acres.
Asadpur ...	35	22,042
Islamnagar	7	4,231
Sahaswan	148	78,279
Ujhani ...	45	38,745
Usehat ...	40	39,640

Kadwara and believed to be an old bed of the Ganges. Along the greater part of the ridge this depression is not an effective drainage channel, being choked by the sand which is carried down from the sandy uplands. The lowland along it is, therefore, badly waterlogged when the rains are heavy, and the higher ground suffers from the scouring caused by the flood water. North of the sand cliffs which overhang the Kadwara there are no regular means for carrying off the flood water, which sinks into the ground or lies in local depressions, and after a few wet seasons the waterlogging rises to a dangerous point. This northern depression is in different places occupied for a short distance by different streams, which cut across to the *khadir ;* where these streams exist they carry off the drainage with fair efficiency, but in the intervals the depression known by different names in different localities, is altogether inefficient and needs clearing out. The rise in the water-level naturally results in contamination of the shallow wells, and fever becomes very prevalent; the population showed a marked decrease between 1881 and 1891. The tract was probably at about the worst stage of depression at the last assessment; and cultivation has extended in the interval.

Surprise has often been expressed at the success of the crops grown on this soil in seasons of drought. The cause is to be found in the inefficiency of surface-drainage: what rain falls is absorbed in the land and retained for a considerable period before a portion of it finds its way underground to the Kadwara.

The Ganges khadir.—This tract includes the whole of pargana Rajpura and parts of Asadpur, Sahaswan, Ujhani and Uschat. It is practically secure against drought, temporary wells being easily made whenever irrigation becomes necessary. On the other hand, most of it is liable to flood and to injury from wild animals. The settlement officer has marked off the following well-defined areas as comparatively stable :—

Pargana.		Name of tract.		Number of villages.	Area in acres.
Rajpura	...	*Khadir* (proper)	...	36	16,136
Ditto	...	*Bhur khadir*	...	16	11,820
Asadpur	...	Changer	...	67	26,467
Sahaswan	...	Baiswara	...	34	13,855

These four assessment circles are continuous, forming a strip of higher ground of varying width between the Ganges and the Mahawa. The rest of the *khadir* may be divided into the following tracts :—

(*a*) the Bela and alluvial villages,

(*b*) the Mahawa tract,

(*c*) the Kamrah tract,

(*d*) the Sot tract.

(*a*) *The Bela and alluvial villages.*—This tract is a narrow strip of alluvial land of recent formation lying along the Ganges : it includes the 90 alluvial villages * and also 41 villages which were settled for the full term and formed into the Bela † circle. The land immediately along the Ganges is barren sand, which will support nothing but the tamarisk. The scrub so formed shelters pig and deer, which do much damage to the nearest cultivation. Further inland where a crust of loam has been deposited over the sand, cultivation begins, and it is to this land that the term " Bela " is specially applied. The soil is fertile with moderate cropping; but it is very thin, the crust of loam averaging only from 12 to 18 inches in depth, and overcropping is a very real danger. Except in the north-west of Asadpur, where part of this tract has been protected by the head-works of the lower Ganges canal, the cultivation is still at the mercy of the river. At settlement this tract was in a state of abnormal prosperity: the Ganges was gradually receding and enlarging

* Pargana.		Number of villages.	Area in acres.
Rajpura	...	14	Variable.
Asadpur	...	14	
Sahaswan		20	
Ujhani	...	14	
Usehat	...	28	
† Asadpur		29	14,561
Sahaswan		12	7,394

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the area available for cultivation; cultivators had been attracted to it from the depressed *bhur* tract; rents had been forced up; overcropping prevailed; and tillage was being pushed beyond the limits of safety. The settlement officer remarked that on the return of the Ganges the prosperity of the tract would go down like a house of cards, even in the villages considered safe from actual diluvion.

(*b*) *The Mahawa tract.*—The Mahawa flows through Rajpura, Asadpur and Sahaswan, joining the Ganges at the south-east corner of the last-named pargana. The handbooks contain lists of villages where it causes special injury; but practically it affects most of the tract between the *bhur* and the high *khadir*, comprising the greater part of the following assessment circles:—

Pargana.	Circle.	Number of villages.	Area, acres.
Rajpura ...	Dhakar or dumat matiyar.	60	62,282
Asadpur ...	Dumat II ...	88	49,644
Sahaswan ...	*Khadir* ...	99	55,766

Serious injury from the Mahawa appears to have begun about 30 years ago, when the Ganges established connection with it in pargana Hasanpur (Moradabad). The river now receives a large volume of flood water from the Ganges: the channel is quite insufficient and the floods sweep over the land destroying the kharif, and frequently retarding the rabi sowings. The silt it leaves is barren, and good land is frequently destroyed as the course of the river straightens. This river caused great injury in the wet years up to 1894.

(*c*) *The Kamrah tract.*—The Mahawa joins the Ganges at the south-east corner of Sahaswan; but in the next pargana, Ujhani, its work of destruction is taken up by the Kamrah. In wet seasons the volume of this stream is increased by the overflow of the Mahawa and it floods a tract comprising the western half of the *khadir* circle (48 villages with an area

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of 45,031 acres). In 1894 a flood entirely destroyed the kharif in many villages. The eastern part of this circle, beyond the scope of the Kamrah, is also liable to flood and to deposit of barren sand from a side-channel of the Ganges.

(*d*) Finally, the *khadir* circle of pargana Usehat (49 villages with an area of 35,411 acres) is flooded by the Sot, which here leaves the upland for the *khadir*. In the *khadir* it is a constant source of damage and danger, its flood-water joining with that of the Ganges and sweeping over the country. In the east of this pargana, however, the Sot is of great service in irrigating a rich rice tract known as the Chaunr, through an indigeneous system of canals.

The eastern lowlands.—This tract occupies the whole of Salimpur, nearly half of Budaun, and the outer lands of the border villages of Usehat. On the extreme east is the Ram Ganga which is bordered by 48 alluvial villages settled quinquennially. All these lie in pargana Salimpur: they are of the usual type, and are at the mercy of the river. West of the alluvial villages is the *dumat matiyar* tract of pargana Salimpur, which extends as far as the Aril and includes 180 villages with an area of 83,373 acres. In this tract the kharif is often jeopardized by floods; but on the other hand the rabi is fairly secure as temporary wells can be sunk almost everywhere. The appendix to the handbook shows 9 villages in this tract as depending almost wholly on the rice crop, and which must therefore suffer in a dry season: 8 villages are specially liable to injury from the floods of Ram Ganga, and 4 from those of the Aril.

West of the Aril lies the Bankatti tract containing 156 whole villages as well as parts of the villages on the Usehat border. The land is heavy clay and depends largely on rice. Where rabi is grown it can usually be irrigated from wells and ponds; but a failure of the rains must bring

	Villages.	Acres.
Salimpur ...	73	46,076
Budaun ...	83	54,060

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distress to those villages which depend largely on rice. The handbook appendices show a few villages as specially liable to injury. In wet years much of the tract is liable to injury from floods.

Water-supply.

There are no government canals in the district, but a system of private canals exists in Usehat which is locally of much importance; in the drought of 1907-8 it irrigated close on 8,000 acres. There is also a substantial amount of irrigation from *jhils* and streams in all parganas.

The temporary percolation-well is the great resource of the greater part of the district, but the last few years have seen a considerable extension in the number of cheap masonry wells. The results of the well-survey of the district have not yet been fully scrutinised: it is known that foundation-clay is not everywhere present, but local knowledge regarding its presence is defective as it has not been the practice to look for it.

Cattle-supply.

The stock of cows in the district taken as a whole is proportionately very low, but considerable numbers are kept in the villages of the *bhur* and *khadir* tracts. The stock has diminished greatly as the result of the extension of cultivation: but there is still a surplus in these tracts, which is mainly sold to *banjaras* for export eastwards. For the district as a whole there is a considerable import of western cattle, distributed by dealers. It is a common practice to buy immature plough-cattle, break them, and after using them for a year or two sell them to dealers for disposal in Meerut or Bijnor. Cattle are also imported from Pilibhit and the neighbouring districts.

The district is liable to all the common forms of cattle-disease and losses are occasionally severe, especially in the *khadir*. The practice of inoculation is now welcomed by the people.

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Budaun.

Annals.

The district has a record of serious distress in the famines of 1803, 1837, 1868 and 1877 ; while the *bhur* tract was greatly depressed as has already been recorded during the wet years ending in 1894.

In 1895 the rains were moderate and the *khadir* prospered, there being only one small flood. The high and dry *bhur* suffered from want of water; but the waterlogged ground north and east of the ridge was benefited. In 1896-97 the great drought benefited the low-lying *bhur* and the Ganges *khadir*, the latter getting an excellent harvest. The drought was, however, again very injurious to the high *bhur*, and the rice villages in the Bankatti suffered severely. In 1897-98 the whole district enjoyed good seasons; in 1898-99 there was some slight flooding in Usehat between the Sot and the Ganges, while the *bhur* was reported to be slowly recovering; field-rats appeared in large numbers and did some damage to the *rabi* crops. In 1899-1900 the drought affected the kharif and the unirrigated rabi on the *bhur* and in the border villages of the *katehr*. In the rest of the district an enormous number of wells were dug, liberal *takavi* being given and the rabi was generally secured. There was a severe local flood in the Mahawa tract in Rajpura, destroying the kharif in parts of 10 villages. The plague of field rats entirely disappeared, but some injury to the rabi was caused by whiteants until the winter rain came in February. Favourable rains in 1900 secured an exceptionally good kharif and the rabi of 1901 was also excellent. The rains of 1901 were at first adequate and there were heavy floods in the lowland tracts ; September was however dry and the rice crop suffered. The rabi of 1902 was affected by drought, but the following kharif was satisfactory. Cultivation was now extending very rapidly in the *bhur*.

Budaun.

The seasonal yields since 1903 are given in the following table :—

Year.		Rabi.				Kharif.					
		All crops.	Wheat.	Barley.	Poppy.	All crops.	Rice.	*Bajra.*	*Juar.*	Cotton.	Sugarcane.
1903	...	79	75	81	94	70	69	69	69	62	81
1904	...	84	81	87	94	81	75	81	85	87	87
1905	...	74	75	81	56	73	56	81	75	94	60
1906	...	77	75	75	87	94	94	100	87	119	94
1907	...	81	75	94	81	49	31	55	44	44	60
1908	...	69	69	81	69	100	87	106	100	94	87
1909	...	83	81	87	75	94	87	94	94	100	100
1910	...	110	113	113	94	73	70	69	62	69	87
1911	...	89	87	94	81	...	...	...	...	...	...

The winter rains of 1903 were deficient and the crops suffered from strong west winds. The following monsoon was not established until the end of July, and the kharif area fell off. Heavy rain in October caused serious injury to cotton and millets, but enabled the largest area yet recorded to be sown with rabi for 1904; this crop was somewhat injured by want of rain and by strong winds. The report noticed that cultivation was still expanding in the *bhur*, but that the course of the Ganges was shifting and villages which had been considered safe were suffering from diluvion.

The rains of 1904 were too light for rice, but they lasted long enough to secure another large rabi area for 1905. The exceptional frosts of this year affected the district unequally : the injury was severe in the *bhur* and *khadir*, while the *katehr* suffered comparatively little. The rains of this year were insufficient throughout but especially in tahsil Gunnaur: rice, sugarcane and *juar* suffered most. The rabi area of 1906 fell owing to the drought, and the crops suffered from inadequate moisture in the early part of the season. The rains of 1906 were favourable and the kharif would have been exceptionally good but for the injury to *juar* caused by a storm with high wind in September. There was too much rain in the winter and wheat suffered from rust.

The rains of 1907 were very short and ceased at the end of August: fair crops were secured in the *bhur* but the lowlands suffered severely. The rabi area of 1908 fell severely in the *bhur*, *khadir* and lowlands; and the crops suffered throughout from want of moisture: tahsil Gunnaur and the upper *khadir* fared worst. Relief measures on a small scale were required during these seasons: gratuitous relief was given from January to June and some small works were opened, but did not attract a large number of workers.

The rains of 1908 were at first heavy and there were floods on the Ganges and Mahawa: September was too dry for rice, and the sugarcane had suffered during the hot weather, but other crops were very successful. The rabi area of 1909 was again contracted owing partly to drought and partly to the very severe outbreak of malaria in the autumn: the winter rains were insufficient throughout and high winds prevailed in March. The report for this year noticed the injury caused in the *khadir* by herds of wild cattle. The monsoon of this year was marked by very severe floods in the *khadir*, and by deficiency of rain in September, but nearly a full *rabi* area was sown for 1910 and exceptional crops were secured. It was noted that the *bhur* tract was fully maintaining its prosperity. The rains of 1910 were so light in July as to injure rice: in August they were heavy, and severe floods occurred in the *khadir* for the third year in succession; while exceptional falls in October did great harm to the millets and cotton. A full rabi area was sown for 1911, but rain in March was followed by rust on wheat and blight on poppy.

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Progress.

The area cropped has increased substantially during the last two decades owing mainly to the recovery in the *bhur* tract: it is now probably very near the maximum.

There has been a marked rise in the proportion of the area sown with remunerative crops, and the proportion is now high. Sugarcane has not so far expanded, but wheat and cotton show marked increases. Twenty years or so ago cotton was sown on less than 30,000 acres, and from 1901 to 1905 the area was about 45,000 acres, but about 70,000 or 80,000 acres can now be expected in favourable seasons. The development is largely the result of the opening in 1906 of the Bareilly-Kasganj railway. Potatoes, tobacco and garden crops are all being extended, and there is now an export trade in the first-named. Poppy has been of great importance in the district, and in 1907 covered 36,000 acres: this has now been reduced to 20,000.

As has been said above there has of late years been a tendency to construct cheap masonry wells instead of relying wholly on temporary wells. The number of masonry wells rose by 51 per cent. between 1905 and 1911: in the latter year there was one such well to 163 acres of normal cultivation as against 247 acres in the former. The only other advance to be recorded is the realisation of the value of loans given for temporary wells in seasons of drought: roughly about twenty times as much money was advanced in 1907 as in 1896.

The population has risen in each of the last two decades and in 1911 stood at 1,053,000 as against 926,000 in 1891.

Agricultural wages appear to have risen on the whole in the last five years, higher rates having come into force in several localities: the rates recorded in 1911 varied from 2 to 3 annas.

Advances for land-improvement have until recently been taken on a small scale in ordinary years: but between 1905

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and 1908 close on three lakhs were advanced mainly for masonry wells, and substantial sums have been given in the two subsequent years. Advances for temporary purposes are taken largely when required, and judging by the figures are increasing in popularity. In 1907-8 advances under this head aggregated over six lakhs. The prospects of agricultural co-operation are most promising: in 1911 there were 118 rural credit societies with over 7,000 members, and financed by the district bank with a working capital of 3½ lakhs: and steady expansion is anticipated in the future.

Until 1905 the bulk of the district was inadequately provided with railways: the opening of the line from Bareilly to Soron has already effected a very great improvement, but the number of stations is still small, there being only one to 182 square miles. The system of metalled roads has been extended by the construction of the road towards Dataganj, and only short additional lengths are contemplated.

The movement of rents has been striking. After settlement (in 1898) the recorded occupancy rents gave a rate of Rs. 3·3 per acre, which has scarcely changed. Other rents gave a rate of Rs. 3·8 which remained approximately constant to 1903. The rate then began to rise; it reached Rs. 4·3 in 1906, Rs. 4·5 in 1908 and was Rs. 5·0 in 1911. The rate of the recent rise has been very great, but it represents largely a levelling-up to the standard of neighbouring districts.

Industries are not important in the district. Weaving and sugar-refining have declined, and the old silk-industry is almost extinct; while the disappearance of indigo has involved the loss of seasonal employment. Organised industry is represented by three ginning and pressing mills which have been established recently.

Judged by the volume of the money-order business, the district obtains only a small income from external sources.

The sums distributed by this system average 5½ lakhs yearly as against 3½ lakhs in the years about 1898, for which figures are first available.

Dangers, and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area under them will fall, though the loss may be made good by larger sowings of *bajra*, which can be sown until nearly the end of August provided the weather is favourable. The tracts where rice is important require more rain than the rest of the district, in the first month for sowing and in the second for transplanting.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage : but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons ; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

The area sown with cotton is affected to some extent by the nature of the sowing season ; an early start and a dry season are favourable. The chief factor determining the area are the profit obtained in recent seasons and the relative prices of cotton and food-grains.

2. The yield of the early dry crops of which maize is much the most important, depends mainly on the weather during the first two months of the season : alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The small

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area under early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops, which yield the bulk of the food and fodder-supply, require the prolongation of the rains to about the middle of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The late rice which is important only in a few localities, requires more rain in September than is desirable for the dry crops, and at least one fall in October is desirable for its complete success.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, the rain in October is beneficial. The crop can stand a considerable excess of rain; but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

The food-supply depends rather too much on the prolongation of the rains through September, and an extension of maize would be an advantage.

3. Apart from variations in the rainfall, the chief danger to the kharif is from floods. These are likely to be most extensive in the *khadir*, but the area enumerated in the section on topography also requires attention.

Serious injury from insect-pests has not been reported but should be watched for, especially in the case of cotton, as the appearance of the bollworm would be a cause of grave anxiety.

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4. The area sown with rabi crops depends on the rainfall of September and early October. Good rain in the latter month produces a large extension, while drought in September involves a reduction. In the *katehr* the reduction need not be very serious if the people are able to make wells, but it must be substantial in the other tracts.

5. Winter rains are very valuable for the rabi provided they are timely and that the falls are moderate and of short duration. Falls in the latter part of February and thereafter may cause some injury, while prolonged periods of damp and cloudy weather in January and February must be expected to produce rust on wheat. The loss from this cause may be very serious, and its extent may not be fully recognised till the crop has been harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring early in January does little harm except to *arhar* and possibly potatoes. Late frosts are a danger but experience does not indicate the period when the risk is greatest: the frosts of the first days of February 1905 caused only local injury.

Hailstorms early in the season cause little loss, but the danger increases as the season advances. The injury is specially severe in the case of tobacco.

The rapeseed crop may be seriously injured by the aphis if damp and cloudy weather occurs while the plants are in flower.

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Budaun.

The poppy crop may suffer severely if damp and cloudy weather occurs late in the season.

The potato-crop may become infected with the potato-moth, and if this occurs energetic action is desirable (vide Provincial Note, section VI).

Whiteants may do considerable harm to the rabi crops in their early stages when the ground is drier than usual.

Field-rats have been known to increase in dry seasons to an extent that involves considerable loss: a wet season usually leads to a decrease in their numbers.

7. The area sown with *zaid* crops is not large in ordinary seasons, but extends to a relatively great extent when stocks of food have been reduced by poor harvests.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the *khadir* and the *bhur*, especially the latter. It is most desirable to maintain a record of the level at which water stands in a few selected wells in this tract on a given day in successive seasons: a marked rise in the level with indications of a reduction in cultivation may make it necessary to take up the question of reducing temporarily the burthen of the revenue.

9. Distress requiring some measures of relief must be expected to occur if the rains cease about the beginning of September, that is too soon to mature the bulk of the *bajra* crop: the stress is likely to be greatest in the *bhur* and the

eastern lowlands. The following measures were taken in 1907-8, when actual distress was very slight :—

Revenue suspended, kharif	1⅓ lakh.
„ „ rabi	Rs. 7,000
„ remitted, kharif	1 lakh.
„ „ rabi	1 „
Improvement loans	2¼ lakhs.
Advance for rabi	3½ „
„ „ kharif	1¾ lakh.
Advances to co-operative societies	⅓ „

Maximum proportion of population relieved 0·5 per cent.

10. It is possible that a serious shortage of fodder may occur in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth : in this case the only remedy that can be suggested is the importation of grass from the Pilibhit forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains : if there are none, it may become very great, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder-famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder ; but in such seasons *juar* occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods : the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. The measures that can be taken for the improvement of the water-supply consists at present mainly of the provision of facilities for masonry wells. The rapidity of construction in recent years indicates that this form of protection is increasing in popularity ; the process can be assisted by (1) improvement loans, (2) the maintenance of a boring staff to

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locate sites, and (3) influencing any of the larger landholders whose estates are inadequately equipped.

Should an effective percolation-well be designed, arrangements should be made for the construction of a sufficient number to serve as demonstrations.

There may be some scope for pumping-installations on the minor rivers.

12. There is at present no demand for drainage works. If however the seasons lead to a rise in water-level in the *bhur* it will probably be found desirable to clear out the Kadwara and other drainage lines so as to facilitate the escape of water.

13. To minimise losses from cattle-disease it is desirable to give steady attention to enforcing the system of reporting outbreaks prescribed in the Land Records Manual, and to maintain a sufficient veterinary staff to localise outbreaks when they occur. It is also desirable that any possible steps may be taken to preserve the existing grazing area in the *khadir*.

14. The supply of agricultural capital is at present insufficient. There are good grounds for hoping that the need will be gradually met by the extension of the co-operative organisation, but for the present there is a wide field for the *takavi*-system. Improvement loans may be wanted chiefly for sinking wells. Agricultural loans may be useful in the following circumstances:—

(a) *Early cessation of the rains.*—Advances to sow the rabi should be given on a very large scale, and there may be a further large demand for the following kharif, while on a smaller scale loans will be useful about February for sugarcane and *zaid* crops.

(b) *Floods.*—Advances may be required in the flooded areas to enable cultivators to sow the rabi.

(c) *Cattle disease.*—It is important that cultivators should be in a position to replace working-cattle by the beginning of the next tillage-season. It may also be desirable to provide funds to enable

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cowowners in the *bhur* and *khadir* to replenish their stock.

(*d*) *Curtailment of the poppy area.*—It may be desirable to offer advances in villages where the crop has been largely grown to enable cultivators to substitute some other remunerative crop.

15. The co-operative organisation has advanced sufficiently to make a beginning in the introduction of agricultural implements requiring associated action. The cropping of the district requires to be examined before definite suggestions can be made for its improvement; but there is a wide scope for a cotton of better quality if a suitable type is found; and probably better varieties of sugarcane can be found for some localities. From time to time the introduction of new strains of potatoes may be desirable. A demand should grow steadily for improved tillage-implements especially in the *khadir*. the scope for expensive machinery is probably limited at present, but the introduction of power-pumps may be found feasible. The cane-mills in general use are as a rule exceedingly insufficient: the supply is mainly in the hands of local men, and it is most desirable that the standard should be raised in any way that may be found possible.

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DISTRICT NOTE.

MORADABAD.

Topography.

At the last settlement the district was described as consisting of the following well-marked tracts:

Ganges *khadir*.	West Hasanpur.	269	Square miles.
Bhur ...	... East Hasanpur, West Sambhal A small part of Amroha.	224	,,
Udla ...	... South-West Amroha, North-West Sambhal.	88	,,
Katehr	... East Sambhal, Bilari ...	597	,,
North central tract	Nearly all Amroha, South-West Moradabad, small portion of Hasanpur.	406	,,
Ramganga *khadir* ...	West Thakurdwara, South-West Moradabad.	159	,,
North-eastern tract	Most of Thakurdwara, Moradabad.	350	,,

The Ganges *khadir* is divided into four narrow belts (1) the *jhil* below the uplands, (2) a higher tract, (3) the open *khadir*, and (4) the edge of the river. The whole area is subject to damage from flood in the kharif, but in ordinary seasons the rabi crops flourish everywhere; in dry years the high tract does very badly as much rabi cannot be sown. Population is scanty and cultivation variable; there are valuable grazing areas in the north. The Ganges flood-water spills over into the channel of the Mahawa, and there is danger of the main stream breaking into the same channel: such a change would affect a relatively small portion of Moradabad but would be a serious calamity in Budaun.

The *bhur* is a strip of land about eight miles wide consisting of irregular ridges of sand with somewhat firmer soil in

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the intervals. Good crops are sown in these depressions (which are called *choiya*), but only inferior staples, chiefly bajra and barley, on the higher fields. The most important feature of this tract is the want of surface drainage; the depressions do not serve as effective drains except near the edge of the tract, and are often blocked by ridges of sand: hence the proportion of the rainfall that sinks into the ground is much higher than usual. The consequences are *(a)* the kharif crops are surprisingly successful in drought at the end of the season, and much more rabi can be grown than would be expected at first sight: *(b)* the water-level rises rapidly in a run of wet seasons, the tract becomes exceedingly unhealthy, cultivation falls off rapidly, and coarse grasses occupy the land affording cover to large numbers of pig.

The *udla* is a small area of hard, gritty soil lying lower than the *bhur* and also than the land on the east. There is no effective drainage, and the land is water-logged, the *bhur* forming a store of water almost about its level: the name is derived from the popular statement that during wet seasons moisture oozes out at the surface on pressing it.

The *katehr* is a continuation of the tract bearing the same name in Budaun. It is a wide level plain of very fertile loam, broken by small ridges of lighter soil, and effectively drained by the Pot and Ari rivers: the valleys of these streams go out of cultivation in wet seasons, but the rest of the tract is stable.

The north-central tract consists mainly of loam of moderate quality, broken by a ridge of sand down the centre and a plateau of inferior soil on the east.

The Ramganga *khadir* is for the most part a fertile, fairly stiff soil: the course of the river changes frequently with disastrous results, but injury from flood occurs only in exceptional years and the silt brought down is usually fertile: the rabi crops flourish even in the driest years. This *khadir* contains considerable areas reserved for grazing as near the city grazing-fees bring in as much income as cultivation.

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The north-east tract is intersected by a large number of rivers flowing from the Tarai on the north: the surface is therefore much diversified. The prevailing soil is a stiff loam, but there are wide plains of inferior rice land, known as *jhada,* while the centre and north of Thakurdwara lie higher and have lighter land of poor fertility.

Water-supply.

The Ganges *khadir* does not ordinarily require irrigation. In dry seasons the streams are used if they contain water, and temporary wells are sunk which give a poor supply. In the high *khadir* however their construction is very difficult and they are little used.

In the *bhur*, temporary wells can be made in the depressions but not in the greater portion of the land, which has practically no source of irrigation.

The *udla* and the *ketehr* are irrigated when required from temporary wells: and in a few parts of the *katehr* foundation-clay is found and the wells carried down to it, while some masonry wells have recently been constructed. Temporary wells can also be made in the north-central tract except on the plateau on the east, which is unirrigated. The Ramganga *khadir* does not require irrigation: while in the north-east tract considerable use is made of the rivers, and temporary wells can be sunk almost everywhere. A few villages in the north of this tract receive water from the Tarai canals.

Masonry wells are little known in the district as a whole, and very few are built annually. The scrutiny of the results of the well-survey by the district staff has not been completed, but it is understood that local information regarding the position of the foundation-clay is very imperfect. In 1909 the settlement officer wrote: "Save in the *khadir* and sub-montane tracts—where they are not required—there is ample scope for improvement in the building of pakka wells, but before money is expended in this direction expert advice is necessary as, unless the *mota* can be reached, the money will be wasted. For the *bhur* especially the extension of pakka wells would be invaluable: canal irrigation would do as much harm there as good and would be, I think, unremunerative."

Cattle-supply.

The stock of cows in the district as a whole is not exceptionally great, but it is concentrated in (1) the north-eastern tract, (2) along the Ganges and to a less extent the Ramganga. There are some large herds in both areas, and these are provided with suitable bulls: but owners of small herds feel the need of bulls keenly, as sacred bulls are very rare. In the north-eastern tract the cows are either grazed locally or taken for the season to the jungles of Kashipur. The herds along the Ganges are grazed in the *khadir*, and there are signs that these grazing-grounds may be curtailed as there has been some extension of cultivation since the settlement. Surplus young stock is bought up by dealers for sale eastwards: that from Thakurdwara is the more valuable as both cows and calves are better nourished there than in the *khadir*. Working-cattle of a superior type are imported from the Punjab through Bijnor.

The district is liable to all the common forms of cattle-disease. Haemorrhagic septicaemia prevails in the *khadir* when the cattle return there after floods, and is popularly regarded as the effect of grazing on the flooded grass. The practice of inoculation is now welcomed by the people.

Annals.

Information regarding the agricultural conditions of the district is meagre until recent years. The first report received in 1895 showed that the *bhur* and the *khadir* had suffered severely from the succession of wet seasons that culminated in 1894: the cultivated area had fallen and tenants were leaving. The district was not severely affected by the drought of 1896, and the numbers in receipt of relief at no time rose to two per cent. of the population; the *khadir* benefited by the drought, but in the *bhur* cultivation continued to decrease. By 1899 however the *bhur* was showing signs of recovery: in that year the autumn rains ceased prematurely and there was a partial failure of the kharif, the rice tracts in Thakurdwara suffering most, while the rabi area of 1900 was contracted all over the district. The following rains were somewhat deficient and rice was affected, but a fair rabi area was sown for 1901 and yielded well. The rains of this year were heavy in August and the *khadirs* were flooded; but a prolonged break in September caused serious injury to rice. The rabi of 1902 suffered somewhat from deficient winter-rains; but the following kharif did well with the exception of rice. A very marked extension of cultivation had now been established in the *bhur* as the result of seasons of moderate rainfall.

The seasonal yields since 1903 are given in the following table.

Year.	Rabi.				Kharif.				
	All crops.	Wheat.	Barley.	Gram.	All crops.	Rice.	Bajra.	Cotton.	Sugarcane.
190^{3} ...	81	81	81	80	91	81	94	81	100
190^{4} ...	94	100	94	94	100	94	94	94	100
190^{5} ...	94	94	105	94	Not available.	44	75	87	60
190^{6} ...	81	81	87	70	104	100	106	106	100
190^{7} ...	Not available.	81	87	75	28	13	37	31	60
190^{8} ...	69	69	81	60	97	87	113	87	81
190^{9} ...	75	75	75	70	95	84	100	100	94
1910 ...	107	106	113	105	77	81	75	62	75
1911 ...	103	100	113	105	...	...	...	...	...

The rabi of 1903 suffered slightly from want of rain and from high winds in March. The following kharif was fairly satisfactory but the cotton and the other late crops were injured by rain heavy in October. In 1904 both seasons were

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favourable, and the rains lasted long enough to secure a very large area for 1905. The crops were threatened first by the appearance of rust in January and then by the exceptional frosts of February; but heavy rain followed, and it was found that no material harm had been done. The rains of this year were late and deficient; rice and sugarcane both suffered from drought. The rabi of 1906 was sown on a reduced area, and the unirrigated crops suffered at first from want of rain but were benefited by a good fall in February. The rains were exceptionally favourable.

The rabi of 1907 was somewhat injured by excessive rain and the monsoon was very late and ceased prematurely. All crops suffered severely and the rice was almost entirely lost; while the rabi area of 1908 was seriously contracted and the crop suffered from lack of moisture and from high west winds in March. Distress was anticipated in the district, but the large advances which were given provided employment, and no relief-works were required, while gratuitous relief was practically confined to the towns.

The rains of 1908 were at first favourable and the *khadir* was flooded in August, but September was too dry for the rice, and the sugarcane had suffered from the drought of the spring. The rabi area of 1909 was reduced owing partly to the drought and partly to the severe outbreak of malaria which prevented field-work: the crops suffered from high winds and insufficient rain, the loss being greatest in the *bhur*. The following monsoon was heavy at first but insufficient for rice in September. The rabi area of 1910 was above normal and the yield was excellent. The rains of this year were light at first and excessive at the end of the season. Exceptional floods occurred in October on the Ganges and Ramganga and there was much damage to property as well as standing crops. The late rain damaged the cotton crop in particular, but enabled a very large area to be sown for the rabi of 1911, and the yield was again exceptionally good.

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Moradabad.

Progerss.

The statistics show a considerable increase in cultivation during the last two decades: part of this represents genuine expansion, and part the recovery of the *bhur*. The proportion of the area devoted to remunerative crops shows steady improvement during this period, and is now high: there has been a marked extension of wheat, the most important staple, and cotton has spread rapidly over the *katehr*, where it has to some extent taken the place of sugarcane. Sugarcane has apparently extended in the north-east tract, but the fall in prices and the rise in wages claimed by labourers have combined to discourage it in the *katehr*, and it has declined substantially in the district taken as a whole.

There has been practically no change in the condition of irrigation: the number of masonry wells has increased but is inconsiderable. The Sarda-Ganges canal will if constructed modify the condition of a large part of the district.

The population rose slightly between 1891 and 1901 and more rapidly in the last decade; in 1911 it stood at 1,263,000 as against 1,179,000 in 1891.

Agricultural wages have risen somewhat in the last five years, and in 1911 the ordinary rates varied from 2½ to 3 annas.

Advances for land improvement were given on a small scale for a few years after the famine of 1896. They were then practically discontinued until the famine of 1907; nearly half a lakh was given in that year and a substantial sum in 1908-9, but the demand appears to be falling again. Advances for temporary purposes are readily taken in unfavourable seasons.

Agricultural co-operation appears to have secured a firm footing in the district. In 1911 there were 84 rural credit societies with over 2,000 members, financed by a strong district bank with working capital of over 3 lakhs of rupees.

The railway system has been greatly extended during the past twenty years, which have seen the opening of the lines fram Moradabad to Rampur, Ghaziabad and Kashipur, as well as the Gajraula-Chandpur branch: in 1911 there was a station to 79 square miles as against 254 square miles in 1891. The extension of metalled roads during the same period has been slight: the soil of a large part of the district is unsuitable for unmetalled roads, and in reviewing the settlement report in 1909 the Board of Revenue recommended that the increase in local rates should be devoted largely if not entirely to the improvements of road-communications.

Recent figures for rents are not available owing to the interruption caused by the settlement proceedings. The recorded occupancy rents for the last two years give a rate of Rs. 4·1 per acre, while non-occupancy cash rents were Rs. 6·5 in 1910 and Rs. 6·8 in 1911. The settlement officer regarded the non-occupancy rents as unstable owing to the rapidity of the rise that had occurred, but the rise appears to be going on at least as quickly as before the settlement.

The chief industry of the district is hand-loom weaving: it has declined under stress of competition but is still of much importance. Sugar-refining has also declined to some extent. The city crafts, the chief of which is metal work, are understood to have made considerable progress. As regards industries organised on modern lines Chandausi has become the centre of an important trade in cotton, and in 1910 there were 11 ginning or pressing mills in the district affording employment to over 1,200 persons. A spinning mill has recently been erected in Moradabad city.

The district appears to derive an exceptionally large income from external sources; the amount distributed by money-order in the last three years has ranged between 21 and 23 lakhs as compared with about 10½ lakhs at the end of the last century; the sources of the income have not been

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ascertained but it is understood that a large proportion is paid in the towns.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be reduced, but rice will extend: and if the second month is fairly dry the loss will be fully made good by larger sowings of bajra, which can be sown until nearly the end of August.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains.

2. The yield of the early dry crops of which maize is much the most important, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more and later rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops which furnish the bulk of the food and fodder supply, require the prolongation of the rains to about the middle of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

The proportion of early food crops is low, and the district depends too much for its food-supply on the latter part of the season: extension of the maize crop would be an improvement from this point of view.

3. Apart from variations in the rainfall the chief danger to the kharif is from floods in the *khadirs* and the valleys of the minor streams. The loss is likely to be greatest in the Ganges *khadir*.

Serious injury from insect-pests has not been recorded but should be watched for: the appearance of the cotton bollworm in particular would be a calamity.

4. The rabi area depends mainly on the rainfall of September and early October. It may rise much above the normal if good rain falls in the latter month, while it must be expected to fall seriously if September is dry. In the *khadirs* the area depends largely on the time at which floods occur: a late flood may leave the land too wet for sowing.

5. Winter rains are in all seasons most desirable for the

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success of the rabi. They are beneficial almost up to the end of February provided the falls are moderate in amount and of short duration. Rain late in the season will probably cause some injury, while prolonged periods of damp and cloudy weather between January and March must be expected to produce rust on wheat and linseed. The loss from this cause may be serious, and its extent may not be fully realised till the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of special importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring early in January does little harm except to arhar. A late frost would probably cause serious injury, but apparently there need be little anxiety as regards the rabi before the second week in February, though the seed-canes reserved for planting may have their vitality destroyed.

Hailstorms early in the season are of little importance: the danger from them increase as the season advances.

The rapeseed crop is liable to serious injury from the aphis if damp and cloudy weather occurs while the plants are in flower.

White ants occasionally cause substantial injury to the rabi when the ground has been dry at sowing time.

7. *Zaid* crops are not sown on a large area in ordinary seasons, and apparently do not extend largely after an inferior kharif, but statistics on this point are defective.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient

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rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the *khadirs* and especially in the *bhur*. It is most desirable that the movement of the water-level in the latter tract should be watched by periodical observations in a few selected wells: when the level is rising and cultivation is beginning to decline, it may be necessary to consider the question of reducing the burthen of the revenue. The north-eastern tract may also be affected by a series of wet years; its climate will probably deteriorate, and cultivation will fall.

9. Distress requiring some measures of relief must be expected to occur when the rains cease by the beginning of September. There is no recent experience of severe distress: the following measures were taken in 1907-8 when direct relief was almost confined to the towns.

Revenue suspended, kharif	2¾ lakhs.
„ „ rabi	Rs. 16,000
Revenue remitted, kharif	„ 20,000
„ „ rabi	„ 15,000
Improvement loans	⅓ lakh.
Advances for rabi	2½ lakhs.
„ „ kharif	¾ lakh.

Maximum proportion of population relieved 0·1 per cent.

10. It is possible that a serious shortage of fodder may occur in some parts of the district in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains: if there are

none, it may become very great, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons juar occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. Something can be done to improve the water-supply by offering facilities for sinking masonry wells, but the practice cannot wisely be pressed on the people. Apart from improvement loans, a boring staff to locate sites should be maintained so long as a demand exists.

Should a practicable form of percolation-well be devised, arrangements should be made for the construction of a sufficient number to serve as demonstrations, particularly in the *bhur*.

There may be scope for some pumping installations on the minor streams.

12. There is at present no demand for drainage-works; but if the water-level in the *bhur* shows signs of rising it would be well to clear out the existing drainage-lines to facilitate the escape of water. The question of draining the *udla* tract is also worthy of investigation: it is possible that a drain between it and the *bhur* might be a valuable protective measure. These questions will become of immediate and pressing importance if the Sarda-Ganges canal is so constructed as to affect the water-level in the *bhur*.

13. In order to mitigate losses from cattle-disease, it is important to enforce strictly the system of reporting outbreaks prescribed in the Land Records Manual, and to maintain

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sufficient veterinary staff to localise outbreaks when they occur.

Any action that may be authorised by Government should be taken to preserve the existing grazing-grounds in the *khadir*; and to ensure an increased supply of bulls suitable for breeding.

14. The district is still inadequately provided with agricultural capital, and there will be room for the *takavi*-system at least until the co-operative organisation has covered most of the ground. There is not at present much scope for improvement loans, which however should be readily granted when required for masonry wells. Agricultural loans may be required in the following circumstances:—

(a) *Early cessation of the rains.*—There may be a large demand for advances to sow rabi, and again for the kharif: while money may be wanted about February in order to plant sugarcane.

(b) *Floods.*—Advances may be required in the flooded villages to enable rabi to be sown.

(c) *Cattle disease.*—It is important that cultivators should be in a position to replace working-stock by the beginning of the next tillage-season. It may also be desirable to offer advances to cow-owners in order to enable them to replenish their herds.

15. The co-operative organisation now offers an agency by which a beginning can be made in the introduction of agricultural improvements requiring associated action. The cropping of the district requires further examination before definite suggestions can be made for its improvement: but there is a wide scope for a better cotton if a suitable one is found, and there is probably room for better varieties of sugarcane in some localities. The level of wages is rising to a point where labour-saving machinery is becoming of

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importance; and improved tillage-implements should be found suitable especially in the *khadir*. The sugarcane-mills are as a rule very inefficient, and anything that may be found possible should be done to raise their standard.

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DISTRICT NOTE.

SHAHJAHANPUR.

Topography.

THE topography of the district, which is by no means simple, is clearly brought out in the classification by circles and sub-circles made in the last settlement, which should be studied with the aid of the maps in the pargana handbooks. There are nine principal tracts which may be described as follows, beginning on the south-west, where the Ganges touches the district.

(1) *The Ganges tract.*—This small tract includes 18 villages, forming the Ganges sub-circle of the Bankati circle in pargana Jalalabad. The soil is either sand or light loam, and is exposed to the river floods which rarely bring fertilising silt. Cultivation extends in dry years and contracts in wet.

(2) *The Bankati.*—This tract comprises 122 villages, that is the whole Bankati circle exclusive of the Ganges tract. It is a hard clay plain, still containing much jungle ; the soil is poor, and requires a great quantity of moisture, while it dries quickly ; the worst of it grows nothing but rice. Irrigation is essential for the rabi. Wells can seldom be made, and water is obtained by damming the streams at the end of the rains, the water being conducted through an indigenous system of canals. The supply is never excessive and is always liable to run short : when this happens the villages near the larger nalas are fairly protected while the rest are liable to suffer acutely if the rainfall is deficient or ill-timed. Communications are bad : roads are few and much cut up by nalas, and almost the whole tract may be under water during the rains. Rice is much the most important kharif crop, and it may be injured either by deficient rain or by

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floods: in the rabi wheat and opium are the principal crops, and both require much water.

(3) *The Ram Ganga* tarai.—This tract lies along the Ram Ganga, and its composition is shown on the margin. The basin of the river is about five miles broad, and the river shifts freely from one part to another, besides flooding the lowlying parts of the tract; the floods are too swift to suit rice. The soil varies from good loam to sand, and is frequently renewed by the valuable silt of the river, which, however, sometimes deposits only coarse sand. Irrigation is hardly necessary, as the soil retains moisture well, but it is useful if the season is at all dry; temporary wells can be made, and a supply of water is also obtained from the old river channels. The kharif is so liable to injury from the river that the rabi (though not exceeding it in area) is much the more important crop. The tract does best when the rains are somewhat below the average and there are light falls in December or January.

Pargana.	Circle.	Sub-circle.	Number of villages.
Jalalabad ...	Tarai ...	All except Umarsenda ...	173
Khera Bajhera	Ram Ganga	All Umarsenda	73

(4) *Bahgul tract.*—This tract includes the villages influenced by the Bahgul, a river which enters the district slightly to the west of Miranpur Katra, and joins the Ram Ganga: it is made up of the sub-circles noted on the margin, together with part of the small pargana of Miranpur Katra (which was not sub-divided for assessment). This tract is inferior to the Ram Ganga tarai: the soil in Khera Bajhera is frequently hard clay, difficult to plough and more or less resembling the clay of the Bankati; the rest is as a rule poor loam. The river floods are less rapid and less extensive than those of the Ram Ganga and rice is much more commonly

Pargana.	Circle.	Sub-circle.	Number of villages.
Jalalabad ...	Tarai ...	Umarsenda	6
Khera Bajhera	Bahgul ...	All, ...	44
Jalalpur ...			30

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grown; but they do not bring silt of any value. Wells are not generally easy to make, especially in the clay, where they are most needed, and the supply in them is often very inadequate. The Bahgul is dammed in places, but sometimes disputes or other causes prevent the construction of the dams, and then there is apt to be considerable loss from want of water.

(5) *The central* bhur.—This is an extensive stretch of light soil lying roughly between the Bahgul and Ram Ganga on the south-west and the Garrai on the north-east. It comprises the sub-circles shown on the margin, and also a small portion of Miranpur Katra; but the Chauki and Jalalabad town sub-circles differ from the rest of the tract. The soil is generally sandy, varying from light loam to *bhur*; the surface is flat with undulations in the more sandy places, here and there a few sand hills. As regards irrigation the settlement officer, writing of pargana Kant, says: "The circle requires as much irrigation as it can get. The soil does not require much water, but almost every field requires some, or would be the better for some; and every field cannot be irrigated. The irrigated area seems to vary with the temporary prosperity or poverty of the people: irrigation involves hired labour, and often more than the *asamis* are able to afford." Water is obtained chiefly from small temporary wells worked by lever, which yield slowly and are soon exhausted. The main crops are bajra and wheat, the latter being of medium quality.

Pargana.	Circle.	Sub-circle.	Number of villages.
Kant ...	Kant ...	All except Garrai tarai ...	174
Jalalabad ...	Bhur...	Chauki ...	14
		Jalalabad town	7
		Rest ...	59
Khera Bajhera	Bhur...	All ...	28
Tilhar			118

The Chauki sub-circle is an inferior tract and suffers in many places from water-logging. The Jalalabad town sub-circle consists of the highly-cultivated villages round the town, and may be classed as stable.

(6) *The central clay.*—This tract comprises (roughly speaking) the lower doab between the Garra and Garrai, and also a stretch of clay north of the former stream. The sub-circles composing it are shown in the margin. The soil in this tract lies low and consists chiefly of very stiff and hard clay, which cannot be worked when dry and which dries very quickly. It requires much heavier rainfall than the lighter soils of the district, and irrigation for the rabi is essential: any serious deficiency in the rains is therefore disastrous. Wells cannot as a rule be sunk in the clay, but they are possible where the soil is lighter. Though low-lying, the tract does not appear to suffer from excessive rain.

Pargana.	Circle.	Sub-circle.	Number of villages.
Jamaur ...	Jamaur ...	All except Pasgawan ...	83
Kant ...	Kant ...	Garrai tarai ...	43
Nigohi ...	Khaimua ...	All ...	51

(7) *The central loam.*—This is a large tract, continuous except where it is pierced by the Khaimua circle of pargana Nigohi (mentioned above). It is composed of the sub-circles shown in the margin: those sub-circles which require separate description are marked with an asterisk: a part of Miranpur Katra may also be classed with this tract. The main tract consists of fairly good loam, on the whole rather light. The cultivation is stable and not liable to any special calamity: temporary wells can be made nearly everywhere. The Garra does not do great harm and its silt is fertilising; the floods on the Khanaut are more violent and do considerable injury to a limited area. This tract

Pargana.	Circle.	Sub-circle.	Number of villages.
Shahjahanpur ...	Shahjahanpur	Khanaut*	21
		Simrai*	16
		Sukheta*	17
		Rest ...	139
Jamaur ...	Jamaur ...	Pasgawan	44
Tilhar ...	Garra tarai	All ...	93
Jalalpur ...	Garra ...		82
Nigogi ...	Dumat ...		101
Baragaon ...	Baragaon		125
Pawayan ...	Gola* ...		62
	Pawayan		96
	Nahil ...	Central ...	41

produces a great deal of sugarcane as well as other high-class crops. There appears to be little danger of over-saturation apart from the sub-circles marked with an asterisk.

The characteristics of these special sub-circles are as follows:

(*a*) *The Khanaut valley.*—The valley itself is subject to heavy floods in wet seasons, and the kharif is very precarious, while the rabi sowings may be delayed or even prevented. If the rainfall is light, there is good sugarcane and excellent rabi. The slopes are poor sandy loam which gives indifferent crops.

(*b*) *The Sukheta valley.*—The soil along this stream is heavy and bad, and liable to suffer from water-logging in wet years. Drought has also serious results as the soil dries quickly. The climate is bad and tenants are hard to keep.

(c) *The Simrai* jhil.—This resembles on the whole Sukheta valley: it is a natural depression with heavy soil that goes out of cultivation in wet years.

(*d*) *The Gola circle.*—This lies on the Khanaut stream, and consists mostly of rather poor loam: irrigation is not plentiful and temporary wells can only be made in the west of the loam (or roughly rather less than one half of the tract). The Khanaut does a good deal of injury to the villages adjoining it.

(8) *The northern* bhur.—This tract is made up of the sub-circles shown on the margin, but is not entirely homogeneous. The soil is generally light

Pargana.	Circle.	Sub-circle.	Number of villages.
Pawayan ...	Nahil ...	Khanant	25
		Jungle...	19
	Samwat ...	Khanaut	33
		Bhainsi	56
	Tarsona ...	Gumti ...	25
		Banda ...	45
		Gularia	26
Khutar ...	Wiran ...	Jhukua	88

and sandy, with a good deal of inferior *bhur*. Population is scanty, and irrigation is greatly deficient, though wells can be made here and there except in the worst villages. The tract deteriorates towards the north where the climate is worse, the drinking water is bad and the people are very poor. The following is a brief description of the special features of the different sub-circles :—

Nahil-Khanaut.—There is very little good land and irrigation is not plentiful though some water can be had in most villages.

Nahil-Jungle.—This circle, which lies in two blocks, is somewhat superior to the average of the tract, but there is much jungle, and the crops suffer from wild animals, while there is waterlogging in parts.

Samwat-Khanaut.—This is about the average of the tract.

Samwat-Bhainsi.—The soil is very inferior : wells are difficult to dig and yield badly. The drinking water is exceedingly bad and the people suffer from fever and other diseases: they are wretchedly poor.

Tareona-Gumti.—This resembles Bhainsi except that it is not specially unhealthy.

Tareona-Banda. This is somewhat above the average as cultivation is very stable and there is good irrigation.

Tareona-Gularia. This is fairly good country : wells are generally possible, and the cultivation is stable.

Wiran-Jhukua.—This is a wilderness of jungle and *bhur* lying on the left bank of the Gumti. The soil is wretched, irrigation is very scanty, wild animals do much harm, the drinking water is bad and the villages are liable to be almost depopulated by disease : consequently cultivation is fluctuating and precarious, carried on largely by tenants who live a long distance off.

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Shahjahanpur.

(9) *The northern loam.*—This tract includes most of pargana Khutar, the most northerly in the district, and is composed of the sub-circles shown on the margin. The two portions of the Abad circle (which are not contiguous) are on the whole generally similar: the soil is fairly good loam, and is well cultivated by a dense population. Temporary wells are generally possible, the northern block being slightly inferior in this respect. The Chandpur sub-circle is an extension of the Northern Abad sub-circle into what was formerly forest, and resembles it generally.

Circle.	Sub-circle.		Number of villages.
Abad	Southern	...	52
	Northern	...	18
Wiran	Chandpur	...	37
	Forest	...	62

Most of the forest sub-circle is uncultivated: the climate is unhealthy: the soil is uniform loam of fair quality, but its value depends on its distance from the forest and comparative immunity from wild animals. Drought is not a serious danger as the climate is so moist that irrigation is hardly needed.

Water-supply.

The conditions of the different tracts in regard to water-supply have been noted above. There is a considerable amount of irrigation from rivers and *jhils*, but the chief source is the temporary percolation-well. The villages where these can be readily made have been recorded in the well-survey: about 130 villages have been noted (mostly in pargana Nigohi, Tilhar, Jalalpur and Khera Bajhera) where masonry wells are believed to be possible and should be constructed; there are also numerous villages in the northern pargana, where masonry wells would be useful but cannot be made owing to the absence of foundation-clay. The number of masonry wells in the district is very small, and nearly half of them are in the single pargana of Shahjahanpur: the people are not interested in the matter, and local information as to the presence or absence of foundation-clay is probably much less trustworthy than in the doab or South Oudh.

Shahjahanpur.

Cattle-supply.

In the three southern tahsils the stock of cows is proportionately very low and the quality poor. A few superior working-cattle are imported from the Punjab and Rajputana, but the bulk of the imports come from Pilibhit, Kheri and Sitapur. Tahsil Pawayan contains a considerable breeding industry. There are some large herds, the owners of which take much care in providing suitable bulls. The cows are mainly of the *Ganjarhi* type, which is closely allied to the Kheri breeds but somewhat inferior to them: the bulls are either of the same type, carefully chosen for quality, or else Khairigarh or Parehar. Most of the large herds graze either in Nepal or in the Pilibhit jungles for the greater part of the year, but use the local jungles during the rains. Apart from the large herds, the stock of cows in the north of the tahsil is very large: the quality is inferior to those of the large herds and the breed more mixed. Suitable bulls for breeding are very scarce. The cows are usually grazed in the local jungles: at present there is no complaint of scarcity of pasture, but cultivation is extending, and it is possible that the small owners may find it difficult to maintain their stock in the near future.

The district is liable to all the common forms of cattle-disease. The attitude of the people towards the practice of inoculation is at present one of indifference.

Annals.

The district has a record of severe distress from drought in 1803, 1837 and 1877: the injurious effects of the last continued for several years. The first report received from the district relates to 1894-5, the last and wettest of the series of wet years. In that year the Ganges and Bankati tracts, and the Ram Ganga *tarai* suffered from excessive floods, the whole country being described as one expanse of water, and both kharif and rabi were very seriously injured. In 1895 the Bankati and the central clay suffered severely from deficient rain: and the two northern tracts were affected by the

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same cause, as the kharif was only half a crop and the absence of winter rain caused the small rabi area of 1896 to be very poor. Test works were opened in Pawayan in May and attracted labour until August.

The rains of 1896 ceased prematurely in August and the kharif yielded less than half the normal outturn, while the ground was too dry for sowing until rain fell in November. The rabi of 1897 was poor, especially in tahsil Pawayan, the Bankati and the clay tracts. Distress was severe in these seasons: relief works attracted large numbers of labourers from October to March, but the numbers fell rapidly at harvest and did not increase seriously afterwards. Gratuitous relief continued until October.

In 1897 the Ram Ganga *tarai* suffered from exceptional floods. In the following year no injury was reported, but in 1899 the early cessation of the rains caused serious injury to the rice in the clay tracts, the outturn being only about five annas: the rabi area of 1900 also fell off, but the produce was good. The next year was prosperous; but in 1902 the yearly cessation of the rains again injured the kharif in the Bankati tract.

The seasonal yields since 1903 are given in the following table:—

Year.		Rabi.				Kharif.			
		All crops.	Wheat.	Barley.	Gram.	All crops.	Rice.	Bajra.	Sugarcane.
1903	...	75	75	81	69	61	62	62	75
1904	...	85	87	87	85	81	84	84	87
1905	...	63	62	70	75	82	75	94	69
1906	...	80	81	81	75	110	119	116	100
1907	...	67	56	87	81	34	25	48	45
1908	...	81	87	94	60	79	56	100	62
1909	...	47	44	62	37	85	75	100	81
1910	...	95	94	94	100	94	100	87	94
1911	...	113	106	122	125	...	...	...	...

Shahjahanpur.

The winter rains of 1903 were deficient and some injury was caused by strong winds: the area irrigated from wells in this year was remarkably high. The monsoon was a month late and the kharif area was seriously reduced while sugarcane suffered: heavy rain in October caused severe injury. A full rabi was sown for 1904, when the winter rains were light. The rains of this year were on the whole favourable, but were not sufficient in September, and the rabi of 1905 was somewhat reduced in area. The exceptional frosts in the spring caused serious injury, chiefly in the *bhur* tracts and river valleys. The rains of this year were delayed, and sugarcane suffered: there was some anxiety, which was relieved by rain at the end of September. The rabi area of 1906 was again contracted and the crops suffered from lack of moisture until good rain fell in February. The monsoon of this year was excellent, securing very fine kharif crops and a full rabi area for 1907: this crop however suffered from drought in January and excessive rain in February and March, leading to severe rust on wheat.

The monsoon of 1907 lasted from 20th July to the end of August, in the interval there were heavy falls, unequally distributed. The clay and Bankati tracts suffered very severely: the central *bhur*, where the rain was heavy, gave fair crops and was fit to sow with rabi. The rabi area of 1908 was however seriously contracted in the greater part of the district, and the crops were weak owing to want of moisture in the early stages. Distress was not serious during these seasons, and it was noticed that the resisting-power of the people was very much greater than in the previous famine: gratuitous relief was given from January to June and a small amount of employment provided on aided works. Fodder was very scarce in the Bankati tract, where hay imported from the forests proved very valuable.

The rains of 1908 were favourable until the end of August, but deficient in September. Rice suffered severely

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and also sugarcane which had already been affected by drought in spring. The ground was dry when seed-time came for the rabi of 1909, and the very severe outbreak of malaria hampered field-work so that the area sown was again very low. Winter rains were very deficient and the crops suffered throughout from lack of moisture, as well as from hail in February and heavy storms at harvest-time. The report for this year mentioned that new settlers were arriving along the Gumti.

The rains of 1909 were on the whole heavy and there were severe floods in the lowlands: but a break in August lasted long enough to injure the rice-crop. The rabi area of 1910 showed a substantial increase though it was not up to the standard: the season was favourable as was the following kharif, though in this case juar was injured by borers. The rabi of 1911 was sown on a very large area as the result of heavy rain in October and yielded excellently: wheat was inferior to other crops owing to a slight outbreak of rust.

Progress.

The cropped area shows some expansion in the last two decades, mainly in the northern tracts where new land has been cleared: the figures show an extension in the centre also but this is rather a recovery as cultivation had fallen off. The proportion of the area devoted to remunerative crops rose sharply during the period covered by the settlement proceedings, but has remained approximately constant for the last decade. The great increase was in wheat: sugarcane has fallen off substantially, and cotton (which is little grown) has not expanded. Poppy extended until 1907, but is now being reduced: potatoes have become of some importance.

The resources of the district in regard to irrigation have not increased materially. The number of masonry wells has increased by 64 per cent. since 1905, but is still almost negligible, there being only one such well to 666 acres of normal cultivation: and there are few signs of their construction

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becoming popular. On the other hand there appears to have been a distinct advance in the recognition of the possibilities of temporary wells, and of the need for very liberal provision of capital for this purpose.

The population rose very slightly between 1891 and 1901 and more rapidly in the last decade; in 1911 it stood at 946,000 as against 919,000 in 1891.

Rural wages have risen somewhat in the last five years; in 1911 the rates recorded lay between 2 and 2½ annas.

As might be expected from the conditions of irrigation, loans for land-improvement were practically never taken until 1907-8. A large sum was given in that year, but the demand has not been maintained. Advances for temporary needs were also formerly little taken, but in the same year very large sums were given with advantage. There has as yet been no development of agricultural co-operation in the district.

The last two decades have seen the opening of the Pawayan steam tramway, the narrow gauge line from Shahjahanpur to Pilibhit, and the broad gauge line to Sitapur. When the sanctioned line from Tilhar to Budaun is opened the railway-system of the district will be practically complete. There has been no material extension of metalled roads in the same period: the chief need of the district appears to be for bridges.

The level of rents in the district is low. The rents of occupancy tenants recorded after the settlement in 1902 gave a rate of Rs. 3·5 per acre, and this has remained substantially unchanged. The average rate on other classes of land has risen in the same period from Rs. 3·5 to Rs. 4·0.

Local industries show a decline. Sugar-refining and weaving have been affected by competition, and the disappearance of indigo has involved the loss of some seasonal employment. Organised industry is represented only by the sugar factory and distillery at Rosa.

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Shahjahanpur.

Judged by the statistics of money-orders paid, the district does not depend largely on external sources of income. The sums distributed about the year 1898 averaged about 6 lakhs annually: the present figure is about 8½ lakhs.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be reduced and rice will extend unless the rain is almost continuous; while bajra will be sown later on if the weather clears.

The area under late rice depends to some extent on the same factor: if early rice has been contracted late rice will extend provided the weather in the second month is suitable. Frequent falls of rain with little sunshine produce an extension: and a long break at this time will reduce the area materially.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; another is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests; while in those localities where manufacturers give advances the views of the manufacturers as to the future are the controlling factor.

The small area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food grains.

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Shahjahanpur.

2. The yield of the early dry crops depends mainly on the weather during the first two months of the season : alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more and later rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

The district relies too much for its food-supply on the prolongation of the rains through September; the early dry crops are sown on a very small proportion of the area, and an extension of maize is desirable. The area under this crop fluctuates widely but is probably on the whole expanding.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. Apart from variations in the rainfall, the kharif is exposed to the following dangers :—

(*a*) *Floods.*—These may cause serious injury in the Ganges, Bankati, Ram Ganga and Bahgul tracts

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as well as in certain areas of the central loam enumerated in the section dealing with topography.

(*b*) *Insect pests.*—Both sugarcane and juar are liable to injury by boring-insects (vide Provincial Note, section VI). Other pests have not been recorded, but they should be watched for.

4. The rabi area depends mainly on the rainfall of September and early October. Good rain in the latter period brings the area substantially above the normal, while drought in September involves a large reduction.

In the tracts liable to flooding, the rabi area may be largely reduced if the floods occur late and leave the ground too wet for sowing.

5. Winter rains are very important for the rabi yield. They are beneficial up to about the middle of February (or later in the north), provided the falls are moderate and of short duration: rain late in the season will probably do some harm, while prolonged periods of damp and cloudy weather between January and March must be expected to result in rust on wheat and linseed. The loss from this cause may be serious, and its extent may not be fully realised till the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring early in January does little harm except to *arhar* and possibly potatoes. Late frosts may injure the staple crops very severely; probably the danger is greatest

in early February. Severe frosts may injure the vitality of the sugarcane reserved for seed.

Hailstorms early in the seasons are unimportant: the risk becomes serious when the crops are forming ears and increases as the season advances.

The rapeseed crop may suffer severely from the aphis if damp and cloudy weather occurs while the plants are in flower.

The poppy crop may suffer serious injury from damp and cloudy weather late in the season.

The potato-crop may be infected with the potato moth, and vigorous action is desirable if this occurs (vide Provincial Note, section VI).

Whiteants occasionally do considerable harm to the young crops in the lighter soil when the seed-bed has been dry.

7. The area sown with *zaid* crops in ordinary seasons is small, and it does not extend greatly when stocks of food have been reduced.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen almost throughout the district, but its effects will be most noticeable in the valleys of the larger rivers and in the lower parts of the central loam. The same process must be expected to lead to increased unhealthiness in the north of the district.

9. Distress requiring some measures of relief must be expected to occur in seasons when the rains have ceased at the beginning of September: probably the central loam

and *bhur* will suffer least. The following measures were taken in 1907-8 when distress was slight.

Revenue suspended, kharif	2 lakhs.
„ „ rabi	⅓ lakh.
„ remitted, kharif	⅓ „
„ „ rabi	nil.
Improvement loans	½ „
Advances for rabi	4 lakhs.
„ kharif	1 lakh.

Maximum proportion of population relieved 0·5 per cent. in February.

10. A serious shortage of fodder may occur in the Bankati and possibly in other parts of the south of the district in seasons when the rains have ceased so early that the crops wither altogether; in this case the only remedy that can be suggested is the importation of grass from the Pilibhit forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains: if there are none, it may become considerable, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder-famine does not necessarily occur when the large millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons juar occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances enable cultivators to replace cattle that have died from this cause.

11. The improvement of the water-supply is not easy, and apparently no general measures are possible at present.

Loans for masonry wells should be given when required, and a boring-staff should be maintained to assist in locating sites. Should a practicable form of percolation-well be devised arrangements should be made for the construction of a sufficient number to serve as demonstrations.

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There is probably scope for the introduction of power-pumps on the minor streams.

12. There is at present no demand for drainage works, but a series of wet seasons may result in complaints from the areas in the central loam and northern *bhur* enumerated in the section dealing with topography.

13. To maintain the breeding-industry, it is desirable that any action authorised by Government may be taken to preserve the existing grazing-grounds in the north of the district, and to improve the supply of bulls in the same region. Special care is also required to minimise losses from cattle-disease in this tract: the system of reporting outbreaks prescribed in the Land Records Manual should be strictly enforced, and the veterinary staff should be sufficient to localise outbreaks where they occur.

14. The district is not rich in agricultural capital: the supply furnished by the sugar-manufacturers is important, but it costs too much: and in the north the people are often very poor. Pending the possible development of a co-operative organisation, there is a considerable field for the *takavi*-system. Improvement loans should be given when required for masonry wells, or other valuable works: agricultural loans may be required in the following cases:—

(*a*) *Early cessation of the rains*—The demand for loans to sow the rabi may be very great, and special efforts will be required for rapid distribution; there may be a further demand for the following kharif, while money may be wanted about February to plant sugarcane, and possibly to sow *zaid* crops.

(*b*) *Floods.*—Advances may be required in the flooded areas to enable cultivators to sow rabi.

(*c*) *Cattle-disease.*—It is important that cultivators should be in a position to replace working-cattle by the beginning of the next tillage-season.

(*d*) *Curtailment of the poppy area.*—It may be desirable to offer advances in villages where the crop has been largely grown to enable cultivators to substitute some other remunerative crop.

15. There is at present no agency to carry out agricultural improvements requiring associated action, nor can such an agency be suggested other than a co-operative organisation. The cropping of the district requires examination before definite suggestions can be made for its improvement; an extension of maize is desirable as a protection, and probably better varieties of sugarcane can be found for some localities. There is not much scope at present for expensive machinery other than pumping-plant, but improved tillage-implements should be gradually adopted, while special attention is required to the question of improving the efficiency of cane-mills.

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DISTRICT NOTE.

PILIBHIT.

Topography.

The district is not homogeneous, and Puranpur has little in common with the other two tahsils. On the extreme north-east is the Sarda tract, a strip of lowland traversed by the Sarda and the Chauka. Much of the land is liable to injury by changes in the course of the rivers: it is very unhealthy and sparsely populated, while the soil is inferior, and most of the cultivation is carried on by non-resident tenants. This tract is separated from the rest of the tahsil by a belt of reserved forest, which runs along the high bank bordering the lowlands on the west, and at its northern end joins the Mala forest belt.

Between the two forests lies the upland tract of Puranpur. The portions adjoining the forests are mostly poor sandy soil with a somewhat unstable population, and the crops suffer greatly from wild animals. Southwards and away from the forests the soil is richer and cultivation is more stable.

The belt of forest along the Mala separates Puranpur from Pilibhit, and extends into the north-east of tahsil Bisalpur. The villages on its western side in Pilibhit resemble those on the east, with poor soil, bad climate, and much injury caused by animals.

The rest of the district shows the gradual transition from the *tarai* to the ordinary conditions of Rohilkhand. In the north of tahsil Pilibhit, there is much clay with numerous swamps, and wide stretches of grazing-land: going south the soil gets lighter, cultivation becomes more general, and

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improves in quality, and the population gets denser. The upland is broken by numerous streams flowing south from the *tarai*. The Deoha has a wide valley with lowlands of very uncertain value owing to the varying nature of the silt deposit: on the other streams the lowlands are of much less importance.

Water-supply.

In Puranpur there is very little irrigation from streams or *jhils*, and there are only sixty-two masonry wells available for irrigation in the whole tahsil. The only important source of irrigation is the temporary percolation-wells: these wells can be made in about two-thirds of the villages of the tahsil, but they are ordinarily impossible in the villages near the forests, which are practically unprotected.

The villages on the north and east of pargana Pilibhit are almost equally unprotected: but in the south of that pargana and in almost the whole of Bisalpur, temporary wells can be made, and much irrigation is done from rivers and *jhils*. Pargana Jahanabad, which lies west of the Deoha, depends on a system of canals which is supplemented by irrigation from the rivers: temporary wells are possible in most of the southern half of the pargana, but they are little needed even in seasons of drought.

In the well-survey 347 villages were enumerated in the district as being inadequately protected and requiring masonry wells if these can be made. Only two of these lie in Bisalpur: 133 are in Puranpur and 212 in Pilibhit. There are exceedingly few masonry wells in these tahsils and the number is increasing very slowly: there is thus no accurate local knowledge as to the presence of foundation-clay, and well-sinking cannot be recommended without a trial-boring to determine if it exists. Borings made recently at the request of landholders have disclosed its existence in about one trial out of two.

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Pilibhit.

Drainage.

The natural drainage of the upland is generally adequate, except in the swamps of the *tarai* and the Mala, and along the upper course of the Khanaut. The river lowlands, and especially the Sarda tract, are necessarily subject to injury from floods.

Cattle-supply.

Tahsil Bisalpur imports a proportion of its working cattle, but the other two tahsils are self-supporting, and Puranpur produces a large surplus for export. The cows are mostly either Panwar, or intermediate between Panwar and Parehar. There are many large herds, the owners of which take great care to provide suitable bulls: most of these herds graze in Nepal for the greater part of the year; the remainder graze in the local jungles. The stock owned in small herds in Puranpur is collectively very large: the cows are of the same type as in the large herds but generally of somewhat inferior quality. The small herds are usually united into larger herds and taken to one of the local forests for grazing from about October to June: they depend on wild bulls which join the herds in the forest. Cows kept in the villages have not as a rule suitable bulls; sacred bulls are very rare throughout the district. The surplus stock is sold to dealers and distributed mainly to Oudh and the eastern districts as far as Gorakhpur.

The district is liable to all the common forms of cattle-disease, but there has been very little rinderpest in recent years. The attitude of the people towards the practice of inoculation is at the present time one of indifference: the practice would probably become popular in the first serious outbreak of rinderpest.

Annals.

The early economic history of the district is included in that of Bareilly of which it formed a part. Shortly after the settlement of 1870 cultivation fell off in the precarious parts of Pilibhit and Puranpur, and the deterioration was increased by the drought of 1877. In that year the district (except part of Bisalpur) did not suffer severe distress, but the bad crops led to abandonment of holdings. Enquiries made about 1880 showed that large areas had gone out of cultivation in Puranpur and the north of Pilibhit, and also in the villages along the Mala in that tahsil. Revenue was in many cases reduced as the results of these enquiries, and in some villages a system of annual assessments was introduced.

Conditions improved until about 1892 when the cultivated area was substantially higher than at settlement. The rains of 1894 were excessive, and with heavy rain in the winter the following rabi was very poor. In 1895 the rains were deficient and ceased early, and the rice crop suffered severely, while a very small rabi area was sown for 1896. The produce was inferior especially in Puranpur, where large numbers of cattle died during the year. Relief was given during this season, but the distress was less severe than had been anticipated.

The rains of 1896 terminated in August, and the late dry crops were very poor while the yield of rice was bad. The rabi area of 1897 fell further owing to the drought, but it yielded well. Distress prevailed throughout the district during this year, especially in Puranpur, and relief was given until the rains of 1897. The following seasons were favourable and the cultivated area recovered steadily. In 1899 the early cessation of the rains involved serious injury to rice. In 1900 rice suffered from insufficient rain early in the season but other crops were fair: the following rabi suffered from rain and strong winds, but the rains of 1901 and 1902 were fairly satisfactory. The seasonal yields since 1903 are given in the following table:—

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Pilibhit.

Year.	Rabi.				Kharif.		
	All crops.	Wheat.	Barley.	Gram.	All crops.	Rice.	Sugarcane.
1903	*	81	85	81	76	75	87
1904	72	81	75	56	94	87	100
1905	74	75	80	81	79	75	87
1906	88	87	95	87	98	100	87
1907	77	75	85	87	31	20	50
1908	72	81	94	37	90	81	37
1909	88	87	94	87	95	97	97
1910	106	106	106	106	84	81	85
1911	92	81	106	100	...	...	...

* Figures not available.

The winter rains were deficient in 1903, and the monsoon was late, while heavy falls in October injured all the late kharif crops. A large rabi was sown for 1904, but was not very successful: the germination of gram in particular was very defective owing apparently to excessive moisture. The following rains were good, and secured a full rabi area for 1905. The exceptional frost of this year did some damage, especially in the south of Bisalpur, and wheat was also affected by rust. Large numbers of cattle died from exposure to cold and wet.

The rains of 1905 were inadequate and there was some anxiety until good falls were received in the second half of September. The rabi area of 1906 was however somewhat curtailed, but the yield was on the whole satisfactory. The following rains were good: but the rabi of 1907 suffered from excess of rain, and locally from hailstorms, and wheat was somewhat seriously attacked by rust. The rains of this year lasted only for about five weeks, and the drought in September involved serious loss of crops and the reduction of the rabi area of 1908 by two-fifths: the rabi suffered throughout from lack of moisture, and gram was very poor. The resisting-power of the people during these seasons caused some surprise: gratuitous relief was given from January to June, but no relief works of any kind were required; the collection of grass in the forests for export to other districts provided a large amount of employment.

The rains of 1908 were satisfactory up to the end of August, but insufficient in September, and the late kharif crops, especially rice, suffered some injury: sugarcane was very poor owing mainly to the dryness of the first half of the year. The drought of September, together with a very severe outbreak of malaria, reduced the rabi area of 1909: the yield was satisfactory though somewhat reduced by high winds in March and heavy rain in April. The rains of this year were favourable, and the district benefited in particular by a good crop of sugarcane and by high prices for the produce. A full rabi area was sown for 1910 and with favourable winter rains yielded exceptionally well. The monsoon rains of this year were deficient in July and excessive at the end of the season, but the excess secured for 1911 the largest rabi area of the last two decades. Excessive rain and damp induced rust on wheat and there was local damage from hail, but the yield on the whole was satisfactory.

Progress.

The last two decades have seen a fall and a recovery in the area cropped, which reached a maximum in 1906-7. The low rabi area of the two following years involved a temporary fall which was almost made good in 1910-11. For the whole period, Bisalpur and Puranpur show slight extensions, and Pilibhit a slight decline. The proportion of land devoted to remunerative crops has not extended materially: wheat has increased, but there has been a substantial fall in sugarcane. Cotton is little grown and has not increased: hemp came into

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some importance in the last decade and a considerable trade was developed with Bombay, but the area has not been maintained of late years.

There has been no improvement in the water-supply beyond the remodelling of some of the canals in pargana Jahanabad: very few masonry wells have been made, and in 1911 there was only one such well to 611 acres of normal cultivation. There has however been a distinct development of the practice of sinking temporary wells when needed: thus in the famine year 1896-7, the area irrigated from these sources was below 40,000 acres, but in 1905-6 there were over 62,000 acres, in 1907-8 nearly 69,000, and in 1908-9 over 72,000 acres.

The population decreased slightly between 1891 and 1901, but the loss has been made good in the last decade: in 1911 it stood at 488,000 as against 485,000 in 1891.

Rural wages have probably risen on the whole in the last five years owing to the establishment of higher rates in particular localities; in 1911 the rates recorded lay between 1¾ and 2¾ annas.

Loans are practically never taken for land-improvement: in 1909-10 over Rs. 3,600 were advanced in the hope of getting some masonry wells started, but nothing was advanced in the following year. Loans for temporary purposes are not taken in ordinary seasons, but in 1907-8 over two lakhs were distributed; and there can be no doubt that loans on at least this scale will be wanted in the next drought. There has been no marked development of agricultural co-operation in this district: in 1911 two rural credit societies were at work, and an early extension was contemplated.

The district is now well provided with railway facilities. The Lucknow-Bareilly line was completed through the district in 1891, and the Pilibhit-Shahjahanpur line in 1911, while the line north to Tanakpur is almost finished. Metalled roads and bridges are much needed, and in this respect little progress has been made though a programme has been drawn up.

The recent movement in rents has been very slight. When revised records were completed in 1903-4, the rents of recorded occupancy tenants gave a rate of Rs. 4·3, and this has not varied since. Other tenant's rent gave a rate as low as Rs. 3·3, and this has risen only to Rs. 3·5.

Among indigenous industries there has been a decline in sugar-manufacture, and in weaving, but carpentry and cartbuilding are carried on at Pilibhit on a considerable scale. The only developement of large industries is the recent establishment of a factory for making sugar direct from cane. A rice-mill was started some years ago with promising prospects but has been closed down owing to quarrels among the shareholders.

The district derives only a small income from external sources: about 2½ lakhs annually is now distributed by money-order, which is more than double the amount 14 years ago.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be reduced but rice will extend; while if it is too dry for rice the total area is likely to fall though there may be an extension of bajra.

The area under late rice varies very widely with the season. It requires frequent falls of rain with little sunshine during the second month, and a long break at this period reduces the area substantially.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons, another is the view of the season taken by manufacturers, who under the system of advances in vogue take an important part in deciding on the area to be sown.

2. The yield of the early dry crops which occupy only a small proportion of the area, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice, the chief staple, requires more and later rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains to about the middle of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

The district at present relies too much on rice and bajra for its food-supplies, and an extension of the area under maize is much to be desired: apparently there is at present a tendency to extend this crop.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

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3. Apart from variations in the rainfall few dangers to the kharif crops have hitherto been reported. Injury may result from floods in the Sarda tract and the valley of the Deoha. Serious injury from insect-pests has not been reported, but should be watched for, especially in the case of sugarcane.

4. The area under rabi crops fluctuates widely with the amount of rain in September and early October. It may fall by almost one-half if this period is dry, and rises largely after good rain in early October.

5. Winter rains up to February are highly beneficial to the rabi in all seasons, provided the falls are moderate and of short duration. Rain late in the season will probably cause some injury, while prolonged periods of wet and cloudy weather between January and March must be expected to produce rust on wheat and linseed. The injury from this cause may be serious, and its extent may not be fully realised till the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring early in January does little harm except to the arhar. Late frosts must be expected to cause serious injury especially to cereals; that which happened in the first days of February 1905 was injurious only in the extreme south, and probably a week or ten days later is the most dangerous period.

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Pilibhit.

Hailstorms early in the season are not important: the danger increases as the season advances.

The rapeseed crop must be expected to suffer seriously from the aphis if damp and cloudy weather occurs while the plants are in flower.

7. The area sown with *said* crops is unimportant in ordinary seasons, and does not extend considerably when food stocks have been reduced.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the Sarda tract and along the north and east of Pilibhit, where the rise in water-level will affect the climate injuriously, and land will probably go out of cultivation.

Another process which may have cumulative effects is an increase of predatory animals in the forests. Should complaints of injury increase, or should land along the forests begin to go out of cultivation, the question of restoring the balance of life should be taken up in conjunction with the officers of the forest department.

9. Distress requiring some measures of relief must be expected to occur in seasons where the rains have ceased by the beginning of September. Its incidence will depend largely on the condition of the people as determined by previous harvests, but Puranpur and the north and east of Pilibhit are most likely to be affected. The following measures were taken in 1907-8, when distress was very slight.

„ remitted, kharif	„ 82,000
„ „ rabi	„ 4,000
Improvement loans	„ 1,000
Advances for rabi	1½ lakhs.
„ „ kharif	¼ lakh.

Maximum proportion of population relieved 0·1 per cent in March.

10. Experience does not indicate conditions in which the shortage of fodder may become so serious as to require Government action. The risk is probably present to some extent in tahsil Bisalpur: should action become necessary the transport of grass from the Government forests is apparently the most suitable measure.

11. It does not seem possible to suggest any large measures for improving the water-supply of the district. Loans for masonry wells should be given when asked for, and facilities provided for making trial-borings, but the construction of masonry wells should not be pressed on the people. If however a practicable form of percolation-well should be designed, arrangements should be made for the construction of a sufficient number to serve as demonstrations.

12. There is at present no demand for drainage works, and the appearance of a demand appears to be improbable.

13. To minimise losses from cattle-disease, it is of special importance in this district to secure early reports of outbreaks. This is provided for so far as the villages are concerned by the rules in the Land Records Manual, which require to be strictly enforced: but the patwaris are not likely to hear of outbreaks in the forests, and it seems desirable that a veterinary assistant should remain in close personal touch with the herdsmen during the grazing-season at periods when here is any reason to apprehend disease. So large a portion f the wealth of the district consists of cattle that the mainenance of an adequate veterinary staff is a matter of the utmost importance.

The private grazing-grounds of the district require protection in any form that may be possible under the orders issued by Government.

The breeding villages require bulls, the supply of which should be organised on the lines laid down by Government.

14. Cultivators are as a whole poor in agricultural capital, especially in Puranpur; and the supply provided by sugar-manufacturers though of great importance is often too dearly bought. For the present there is considerable scope for agricultural loans, but little for improvement loans. Agricultural loans may be required in the following cases :—

(a) *Early cessation of the rains.*—There should be a large demand for advances to sow rabi, and possibly for the ensuing kharif, while money for planting sugarcane may be wanted about February by cultivators who are not financed by manufacturers.

(b) *Floods.*—Advances to sow the rabi may be required in the Sarda tract, and possibly also along the Deoha.

(c) *Cattle disease.*—It is important that cultivators should be in a position to replace working-cattle by the beginning of the next tillage-season. It may also be desirable to offer advances to cow-owners to enable them to replenish their herds when these have been reduced.

15. There is at present no agency which could introduce improvements requiring associated action ; the co-operative organization may develop so as to serve in this respect, while if the pioneer sugar-factory is successful and is followed by others the managers will naturally be in a position to introduce better varieties of sugarcane and better methods of cultivation.

cropping of the district requires to be

efore definite suggestions can be made for its improvement, ut it is believed that better varieties of sugarcane and wheat n be found. The scope for machinery is at present comaratively small, and the most urgent matter is to raise the andard of sugarcane mills, which at present are very infficient.

DISTRICT NOTE.

FARRUKHABAD.

Topography.

THERE are extensive lowlands along the Ganges, while the main upland portion of the district is broken up by the valleys of the Kali Nadi and Isan Nadi. There are thus six principal tracts: (1) the lowlands, (2) the north-Kali uplands, (3) the Kali valley, (4) the Kali-Isan uplands, (5) the Isan valley, and (6) the south-Isan uplands.

1. *The lowlands.*—This tract includes the whole of tahsil Aligarh, most of pargana Kampil, and parts of Shamsabad West, Pahara, Bhojpur, Kanauj and Talgram. The number of villages included in the tract is shown in the margin; those classed as "alluvial" are liable to the erosive action of the river: the "non-alluvial" villages are not liable to erosion, but are subject to flooding, while the "mixed" villages are those which lie on the edge of the river valley and are composed partly of lowland and partly of upland.

Pargana.	Alluvial.	Non-alluvial.	Mixed.
Amritpur ...	76	67	...
Khakatmau ...	14	31	...
Paramnagar ...	21	12	...
Total tahsil ...	111	110	...
Aligarh—			
Kanauj ...	43	6	3
Talgram ...	1	...	...
Bhojpur ...	10	...	...
Pahara ...	16	8	9
Kampil ...	43	57	38
Shamsabad West	26	22	21
Total ...	250	203	71

Tahsil Aligarh is affected not only by the Ganges but by the Ramganga, and consists of two bands of alluvial villages divided by rather higher ground.

This tract is almost immune against drought; irrigation is not usually required, but when necessary temporary wells can be made in most places at a trifling expense. On the other hand, the kharif crops are exposed to injury from floods, while in wet seasons the land gets waterlogged, and is soon covered with coarse grasses, which harbour injurious animals. Thus deterioration once started tends to spread rapidly.

Tahsil Kaimganj.	
Kampil	58
Shamsabad West ...	177
Sadr tahsil.	
Shamsabad East ...	80
Muhammadabad ...	43
Bhojpur ...	133
Pahara	47
Total ...	538

2. *The north-Kali uplands.*—This tract includes the upland of Kaimganj and of the Sadr tahsil, and comprises 538 villages as shown in the margin. It is traversed by the Bagar Nala. The land along each of the rivers is light, passing into *bhur*; away from the rivers it is firm loam passing into clay with stretches of *usar*. Villages round the towns have such fine cultivation that for assessment they have been classed as separate "suburban" circles. The sandy areas are liable to be overrun by *kans* in unfavourable seasons.

Shamsabad East	29
Bhojpur	27
Talgram	25
Chhibramau	23
Kaunuj	30
Total ...	134

3. *The Kali valley.*—This tract includes 134 villages, distributed as in this margin, which lie wholly or partly in the valley of the Kali Nadi. The valley is in some places separated from the uplands by a sharp rise, but more usually there is a long slope of poor sandy soil, broken by ravines. Except on the slope the land can be irrigated from temporary wells or from the river itself: the level ground is exposed to moving floods in the rains, and tends to become waterlogged after a run of wet seasons.

Talgram	72
Chhibramau	97
Kanauj	150
Total ...	319

4. *The Kali-Isan uplands.*—This tract comprises 319 villages, as shown in the margin. The soil in the centre of the tract is firm loam or clay with considerable areas of *usar*, especially in

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Talgram; the loam becomes lighter as the rivers are approached and there is *bhur* along the edge of both valleys.

Chhibramau	... 15
Talgram	... 15
Kanauj	... 20
Tirwa	... 23
Sakrawa	... 1
Saurikh	... 17
Total	... 91

5. *The Isan valley.*—This is a small tract containing 91 villages along the river. There is on each side a belt of low land, then a band of uneven *bhur*, in many places broken up into ravines, and and then a more level stretch of culturable *bhur*. The lowland is irrigable from the river, while the *bhur* is usually dry.

Tirwa ..	... 86
Sakatpur	... 52
Sakrawa	... 45
Saurikh	... 30
Total	... 213

The south Isan tract.—This tract includes all of tahsil Tirwa outside the Isan valley —213 villages in all. There is light soil along the edge of the Isan tract: away from the river the soil get stiffer and there is much clay, on which rice is grown, and *usar* plains and *dhak*-jungle appear.

Water-supply.

In the north-Kali uplands there is some irrigation from the Fatehgarh branch canal in the villages lying north of the Bagar, but the bulk of the tract depends on wells. Temporary wells lasting from one to three years are made very cheaply in all land except the *bhur*; masonry wells are possible throughout except in the *bhur*, and are apparently increasing in popularity.

In the Kali-Isan uplands, the Bewar branch canal supplies water to the west of Chhibramau; the rest of the tract depends mainly on wells, which can be made everywhere except in a few localities, specified in detail in the records of the well-survey. In this tract also masonry wells are increasing in popularity.

The south-Isan tract is watered chiefly by the Cawnpore branch canal, which passes through it, but temporary wells

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are also largely employed. Masonry wells are not increasing at the same rate in this tract as in those previously mentioned.

Drainage.

The natural drainage of the district was very defective, but has been improved by correcting the channels of some of the rivers and by an extensive system of artificial channels. The work is believed to be practically complete, but a series of wet seasons may bring defects to light.

Cattle-supply.

The district as a whole has a very small supply of cows and is not self-supporting in the supply of working-cattle. There are however considerable number of cows in the lowlands in Kaimganj tahsil; it is noteworthy that tahsil Aligarh, which is entirely lowland, keeps buffaloes rather than cows. In Kaimganj the herds graze in the *khadir*, where bulls are not found in adequate numbers. Working cattle are brought into the district for sale by local dealers, who purchase partly at the Punjab fair, partly at Kosi in Muttra, and partly from Batesar and other fairs in the provinces.

The district is liable to all the common forms of cattle disease. The practice of preventive inoculation is now welcomed by the people.

Annals.

The district, like others in the doab, was devastated by the famine of 1837-8, the after-effects of which necessitated a reduction of the revenue in 1845. The droughts of 1861 and 1868 appear to have had little effect, while in 1877 the kharif was generally better than in neighbouring districts. There was however some distress during the cold weather and relief works were necessary; the rabi brought relief.

Before this there has been complaints of the spread of *kans* in certain sandy villages along the Bagar and the Kali Nadi. At the same time the Kali Nadi *khadir* was found to be depressed, owing to causes that were disputed; apparently more water came into the river than the lower part of the channel could carry off, and the lowlands were consequently flooded.

From 1884 onwards a series of wet seasons led to serious deterioration, and eventually the revenue had to be reduced in over 300 villages throughout the district. The deterioration was due to over- saturation following a rise in the water-level, and appeared mainly in the lighter soils and in the lowlands along the rivers : the phenomenon is known locally as *gharki.* Considerable drainage works were undertaken by the Irrigation department but no very great improvement was noticeable until dry seasons recurred. Investigation made in the similar tract of Etah showed that the natural drainage is very defective, and that most of the rainfall is absobbed by the land ; the result is that the water-level may rise very rapidly to the point where cultivation becomes unprofitable, while it falls slowly in dry seasons.

When the first of the annual reports was submitted in 1895, the majority of the relieved villages showed some improvement, but some, especially the *bhur* in Talgram, were still depressed ; heavy rainfall had continued, so that there was the less chance of recovery in these villages. The Ganges floods in 1894 prevented the sowing of kharif in the Aligarh tahsil. This year marked the end of the series of wet seasons. The rains ceased prematurely in 1896, and there was a serious loss of the kharif, but the rabi area of 1897 was on the whole fairly well maintained and the yield was good ; the fall in area was greatest in Talgram, Bhojpur, Shamsabad East and Muhammadabad. Relief was necessary during these seasons, but distress was not severe, and the district recovered rapidly up to 1902 ; there were no years of heavy rainfall and no general calamities, though there were occasional floods on the rivers, and in 1901 wheat was seriously affected by rust. The cultivated area in 1903-4 when complete returns were received after the interruption caused by the settlement amounted to 660,340 acres as compared with 565,102 acres in 1894-5, the last year of heavy rainfall. The seasonal yields since 1903 are given in the following table :—

Year.	Rabi.					Kharif.			
	All crops.	Wheat.	Barley.	Potato.	Poppy.	All crops.	Maize.	Juar.	Cotton.
1903 ...	88	94	94	...	100	71	75	69	62
1904 ...	94	94	100	94	81	87	75	94	75
1905 ...	66	62	62	87	87	70	75	62	94
1906 ...	80	81	87	87	81	88	87	87	113
1907 ...	83	69	94	94	87	61	69	56	62
1908 ...	84	87	94	100	62	92	100	87	87
1909 ...	88	87	94	94	75	84	87	69	81
1910 ...	99	100	100	100	75	90	100	81	100
1911 ...	90	87	94	100	50	...	...	...	...

In 1903 the rains were at first insufficient, while heavy falls in October damaged the cotton and millets. In 1904 the lowlands suffered from floods in August and maize was injured by heavy rain. In the rabi of 1905 the cereals as well as arhar and minor crops suffered severely from the exceptional frost of February, and this season marks the close of the period of prosperity which had lasted on the whole from 1897.

The rains of 1905 were insufficient throughout, but falls at the end of September removed the danger of actual distress and a fairly satisfactory rabi was sown for 1906. It suffered from hot winds in March, and locally from hail. The kharif of this year was not so good as had been hoped for owing to untimely falls of rain, while in the rabi of 1907 wheat suffered severely from rust.

The rains of 1907 were very late, and September was dry. The rabi area of 1908 was therefore contracted, and moisture

insufficient to enable the crops to resist the hot winds of
h. During these seasons advances were taken on a large
and gratuitous relief was given from January to April :
istress was at no time severe, and relief-works were not
red. The rains of 1908 were at first good, but were some-
deficient in September : and a very severe outbreak of
ia hindered field-work so that a full rabi could not be
for 1909. Floods did much injury in the lowlands dur-
e rains of this year, and juar was injured by insects and
ufficiency of rain in September. An extended rabi area
wn for 1910, and the crops except poppy were exception-
good. The rains of 1910 were too scanty at first to
a full kharif area ; but the crops were good except juar
suffered from excessive rain at the end of the season.
abi area of 1911 was again large, and most crops did well :
ppy suffered severely from blight, and wheat was affect-
rust. In this year attention was drawn to the spread
baisurai weed in tahsils Tirwa and Aligarh.

Progress.

The fall in the cropped area which took place as the result
r-saturation had been fully recovered by about 1901 and
has been no expansion since, nor is there room for it.
proportion of remunerative crops has apparently risen
ptibly in the last two decades. Indigo (which occupied
15,000 acres) has almost disappeared, and the sugar-
area, which fluctuates widely in this district, cannot be
o have increased, but cotton is more largely grown, and
has increased very markedly. The specialities of the
t, potatoes and tobacco, are both extending, and in 1911
ied as much as 13,000 acres of each. Poppy extended
y during the period under review, but is now being
ed. The late settlement officer recorded the opinion that
uplands the loss of this crop would not be serious, but
pecial attention should be given to the lowlands where no
y remunerative crop can be grown.

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There has been some development of the practice of sowing certain kharif crops with the aid of canal-irrigation. In 1910, when the rains were late, the proportion of maize, cotton and fodder (taken together), so sown amounted to 30 per cent., but in ordinary years the proportion is nearer 15 per cent.

There have been no material improvements in the canal-system which protects about the same area in seasons of drought as it did 15 years ago. The drainage of the canal-tracts has however been improved in this interval. Construction of masonry wells received considerable impetus from the droughts of 1905 and 1907, but the impetus appears to be declining in force. There was in 1911 one such well to 64 acres of normal cultivation as against 82 acres in 1905. Practically no hostility on the part of landholders towards well-sinking has been reported.

The population of the district, which had fallen somewhat seriously between 1881 and 1891, showed a marked rise in 1901, but has fallen by 25,000 in the last decade, and now stands slightly below that of 1881. Agricultural wages have risen in the last five years and in 1911 ranged from 2¼ to 3 annas, the latter rate being not uncommon.

Loans for land-improvement have for long been taken on a small scale in ordinary years, and they have apparently become more popular since 1905 : the issues for the last three years average about Rs. 6,000, as against Rs. 2,000 to Rs. 3,000 before that date. Loans for temporary purposes are also popular, averaging about Rs. 5,000 in ordinary years. These loans are particularly desirable in a district which depends so largely on temporary wells. There has so far been no development of co-operative credit.

The railway-system has been improved by the opening of the line to Shikohabad, and there is now one station to 140 square miles. The chief need of the road-system is a bridge er the Isan river to give communication with the trans- n tr[illegible] : the project for this work has been sanctioned, but ds [illegible] not available.

Rental statistics are available since 1903-4 when settle- nt proceedings were completed. The rents of occupancy ants then gave an average rate of Rs. 4·4 per acre, which l not changed appreciably up to 1910-11. Competition its gave a rate of Rs. 4·0 in 1903-4, which rose steadilty to . 4·9 in 1910-11.

Weaving has declined under competition, but two special anches of the textile industry, cloth-printing and tent- aking, have developed at the head quarters town, and the nufacture of perfumes at Kanauj is apparently holding its n. There has been some loss of rural employment owing thhe decline of indigo, but the extraction and refining of tpetre has developed, and affords a considerable amount of ployment, crude saltpetre being imported from the surround- ; districts to supplement what is extracted locally. There s been no development of organised industries, and there is t as yet even a single ginning mill.

The sums distributed annually in the district by money- ler have risen in the last decade from about 10 to nearly lakhs ; the rise has been most marked since 1906, but its use has not been ascertained.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on e weather during the first month of the season counting from e first heavy fall of rain. An early beginning is an advan- ge, but the most important point is that there should be ight whether with just sufficient rain to enable tillage and wing to prceed, without interruption. If the first month wet, sowings of dry crops will be delayed and the area will ll, though the loss may be to some extent made good by larger

early the end of August.

The area which is planted with late rice is small : its
tent depends mainly on the weather of the second month,
hich should be wet, and a long break at this period results in
reduction.

The area planted with sugarcane is influenced by the
eather in the early spring, at which time rain facilitates
llage : but it is determined mainly by ecomomic causes.
ne of these is the yields and prices obtained from the crop in
cent seasons ; the other is the financial position of the culti-
tors, which depends mainly on the success or failure of the
eceding harvests.

The area sown with cotton is affected to some extent by
e nature of the sowing season ; an early start and a dry
ason are favourable. The chief factors determining the
ea are the profit obtained in recent seasons, and the relative
ices of cotton and food-grains. Taking a longer view, the
ea is affected largely by facilities for marketing and an
tension would probably result from the opening of
nning mills at the centres where the crop is largely
own.

2. The yield of the early dry crops, of which maize is
uch the most important, depends mainly on the weather
ring the first two months of the season : alternations of rain
d bright weather are desirable, and the yield may be much
duced by excessive rain in the second month. The small
ea under early rice requires more rain, and is not likely to
ve a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains
the middle of September or later : they may be seriously
jured by heavy falls in the end of September or the beginning
October, while they will give very little grain if September
altogether dry.

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The late rice requires more rain in September than is ble for the dry crops and where canal water cannot be at least one fall in October is desirable for its complete ss.

The proportionately large area sown with maize goes far sure the food-supply of the district in years when Sep- er is dry.

Sugarcane is apt to suffer seriously at two periods. The is the end of the hot weather: the crop benefits from an commencement of the rains and suffers from delay. second is the end of the rains: a premature cessation is injurious, and rain in October is beneficial. The crop stand a considerable excess of rain, but prolonged breaks likely to cause injury.

Cotton is liable to considerable injury from excessive rain: most dangerous times are probably just after sowing, and n at the end of the season. It can withstand fairly long ks when once it has made a fair start, and suffers from a September less than any other crop.

3. Apart from variations in the rainfall, the chief ger to the kharif crops arises from floods in the lowlands in the valleys of the Kali Nadi and Isan. The loss is porary only if the land is left in good condition for rabi- ings; but if these are prevented, some relief in the matter revenue-collection may become necessary.

Juar is liable to considerable injury from boring-insects de Provincial Note, section VI). Other insect-pests have been reported, but they should be watched for especially the case of cotton and sugarcane.

4. The rabi area depends mainly on the rainfall of Sep- nber and October, and may fall substantially when this riod is dry; the fall can however be mitigated if the people in a position to make full use of the facilities for *paleo-*

irrigation, and advances should be given in such seasons on a large scale.

In the lowlands and the river valleys, the rabi area may be reduced if late floods leave the land unfit for sowing.

5. In ordinary seasons when the seed-bed has been sufficiently moist, the bulk of the rabi can be matured without winter rains ; these however are beneficial up to the early part of February, provided the falls are moderate and of short duration. Rain in March and April will probably cause some damage, while prolonged periods of damp and cloudy weather between January and March must be expected to produce rust on wheat ; the loss from this cause may be very serious, and its full extent may not be realised till the crop is harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case : a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring early in January may injure arhar, potatoes and the early crop of the tobacco, but will not affect the staple crops seriously ; frost at the end of the month or early in February may cause very serious injury.

Hailstorms early in the season will not do much harm except to the early tobacco ; the danger to staple crops begins about the time the cereals are earing, and increases as the season advances.

The rapeseed crop may be seriously injured by the aphis if damp and cloudy weather occurs while the crop is in flower.

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The poppy crop may suffer severely from damp weather late in the season.

A careful watch should be kept for the potato-moth (Vide Provincial Note, section VI), the spread of which would involve very serious loss to the potato-growers.

7. The area sown with *zaid* crops is considerable. It consists mainly of tobacco planted after potatoes, and it does not extend largely in unfavourable seasons, though there may be some increase in the area under melons, &c.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts, but this is not known to have occurred.

On the other hand, a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the *tarai*, the river valleys, and the sandy areas of the North-Kali uplands. All these tracts should be watched very carefully in such seasons, and any decline in cultivation should be regarded as a serious symptom, necessitating close attention to the collection of the revenue, and probably a temporary reduction of its burthen.

9. Distress requiring some measures of relief must be expected to occur if the rains have ceased by the beginning of September. The following measures were taken in 1907-8, when the need for direct relief was very slight :—

Revenue suspended, kharif	... ...	Rs. 46,000
Ditto rabi	... ...	„ 10,000

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Revenue remitted, kharif	... ...	Rs. 8,000
Ditto rabi	... ...	„ 12,000
Improvement loans	... ...	½ lakh.
Advances for rabi	... ...	3 lakhs.
„ „ kharif	... ...	½ lakh.

Maximum proportion of population relieved 0·3 per cent in February.

10 A general fodder-famine appears to be a very remote contingency. There will probably be local deficiencies in seasons when the rains cease so early that the late millets make little growth, and advances to buy fodder may be required: but the need for importation is not likely to be great unless the rains fail entirely.

In dry seasons juar occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth and its presence cannot be recognized beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. No large improvements in the water-supply can be suggested, but all possible assistance should be given to cultivators who wish to sink wells; improvement loans should be readily available for this purpose, and a boring staff should be employed to assist in locating sites.

Should a practical form of percolation-well be devised, arrangements should be made for the construction of a sufficient number to serve as demonstrations in those areas where foundation-clay is not met with.

12. There is at present no demand for drainage-works, but the district should be watched carefully in wet seasons, special attention being given to the movement of the water-level in the North-Kali uplands. If the level begins to rise prompt steps should be taken to clear out any drainage lines that may be obstructed.

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13. To minimise losses from cattle-disease, attention should be given to securing prompt reports of outbreaks under the rules contained in the Land Records Manual, and a sufficient veterinary staff should be maintained to localise outbreaks where they occur.

Any action that may be authorised by Government should be taken (*a*) to preserve the grazing grounds in the Kaimganj lowlands, and (*b*) to improve the supply of bulls in the same area.

14. The district is not sufficiently provided with agricultural capital and for the present at least there is a wide field for the *takavi*-system. Improvement loans are required mainly for well-sinking. Agricultural loans may be wanted in the following circumstances :—

(*a*) *Early cessation of the rains.*—There may be a very large demand for advances to sow rabi, and possibly again for the kharif, while on a smaller scale money may be wanted in the early spring to plant sugarcane and extend the *zaid* area. Advances to buy fodder may also be required.

(*b*) *Floods.*—Advances may be required to enable the rabi to be sown in villages where the kharif has been injured.

(*c*) *Cattle disease.*—It is important that cultivators should be in a position to replace working-cattle by the beginning of the next tillage-season.

(*d*) *Curtailment of the poppy area.*—It may be desirable to offer advances in villages where the crop has been largely grown, in order to enable cultivators to substitute some other remunerative crop.

15. There is at present no agency for the introduction of agricultural improvements requiring associated action.

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As regards cropping there is room for a better cotton when available, and probably the varieties of sugarcane can be changed with advantage in some localities at least. The introduction of new strains of potatoes should be considered from time to time; and probably detailed examination of the cropping will disclose other possibilities.

The simpler forms of improved tillage implements should be found useful, particularly in the *tarai*, and their introduction would probably be effective in controlling the *baisurai* weed (vide Provincial Note, section VIII). The efficiency of the sugarcane mills in use is understood to be low and the type can probably be improved.

16. A special need of the district is the bridging of the Isan to give the Tirwa tahsil convenient access to the railway: there seems to be little prospect of this being done from local resources within a reasonable time as the funds are not available.

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DISTRICT NOTE.

ETAWAH.

Topography.

THE district is divided into four natural tracts, known locally as *pachar*, *ghar*, *kurka*, and *Jumna-par*.

The *pachar* includes all the country north of the Sengar, or slightly more than half the district: the whole of tahsil Bidhuna, half of Bharthana and portions of Etawah and Auraiya lie in this tract. It is mostly good, loamy soil interspersed with beds of clay, but contains large tracts of *usar*. The two streams which traverse it, the Pandu and Arind, are of little importance. The Sengar runs in a deep bed with ravines which become extensive east of Etawah.

The *ghar* extends southward from the Sengar to the edge of the high land above the Jumna, and includes the greater part of Auraiya and part of Etawah and Bharthana. It is a light, fertile loam with no *usar*; and very little clay: sandhills occur in parts of Bharthana.

The *kurka* is the land along the Jumna; and includes a band of high-lying cultivation along the north, then a large area of wild ravines, then a low-lying plain of rich soil (*kachar*) more or less exposed to the river floods, and finally the *tir* or alluvial soil on the border of the stream. In places however there is no *kachar* or *tir* as the river flows close to the bluffs. The silt of the Jumna is very fertile.

The *Jumna-par* tract extends from the river to the southern border of the district in the west of Auraiya and along the border of Bharthana and Etawah. Most of this tract is a

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network of ravines leading either to the Jumna or to the Chambal; there is practically no level upland except in the west of Etawah, but some of the villages on the Jumna contain excellent *kachar* land. The silt of the Chambal is here less fertile than that of the Jumna.

Water supply and drainage.

The *kachar* is largely irrigated from the Etawah branch canal which traverses the centre, and from the Cawnpore branch which runs a short distance to the north of its limits. Both masonry and temporary wells can usually be made in this tract; foundation-clay is ordinarily present and the water-level is not deep. The east of Bidhuna gets less canal-water than the rest of the tract, and there are a few villages, noted in the detailed records of the well-survey, where more masonry wells are needed, and a larger number which require advances for temporary wells in a dry season. The natural drainage of the tract has been improved as necessity arose, and water-logging is not anticipated.

In the *ghar*, water lies as a rule so far below the surface that well-irrigation is very difficult though wells can be made in most places. Practically the whole of the tract has been supplied since 1880 by the Bhognipur branch canal. The small area in the extreme west lying between the Sengar and the Sarsa is without canal-water: it has recently been examined by the Irrigation department, who consider that the supply from temporary wells is sufficient and that the introduction of the canal would probably lead to deterioration of the soil: this area therefore needs special attention in a dry season to secure that any necessary wells are made in time. The introduction of the canal has not appreciably raised the water-level in the main tract and there appears to be now no risk of water-logging. Something of the kind occurred about 1890 close to the Sarsa west of Etawah town, but the drainage there was improved, and there have been no further complaints.

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In the *kurka* and *Jumna-par* tracts, the depth to water and the uneven surface of the soil almost put irrigation out of the question; but masonry wells can usually be made though at a great cost, in the small level portions. These tracts are over-drained and have suffered greatly by denudation.

Cattle supply.

The stock of cows in the *pachar* and *ghar* tracts is not large, and needs are met largely by importation; dealers come from the Punjab and the Batesar fair and sell in the district, while cattle are also brought in from Gwalior. In the *kurka* and *Jumna-par* tracts there was formerly a large number of cows, and some owners could be classed as professional breeders. There were, and are, very good bulls set apart for breeding in these tracts, but the number of cows has decreased very seriously owing to losses by drought, particularly in 1905-06.

Recent experience shows that the district is liable to outbreaks of all the common forms of cattle-disease. The practice of preventive inoculation is now welcomed by the people.

Annals.

The whole district suffered very severely in the famine of 1838-39, but in 1861 and again in 1868 the effects of drought were severe only in Auriaya, which was then almost wholly unirrigated. During the settlement operations between 1869 and 1875 the only deterioration noticed was due to obstructions to drainage caused by the canals in certain places; it was not widespread and has been remedied. In the next famine year, 1877-78, there was no general distress; relief works were opened for a short time in the cold weather, but the distress practically came to an end when the rabi was harvested in April.

Between 1890 and 1895 various tracts where the drainage was found to be obstructed were gradually taken in hand and drains made. With the drought of 1896 all complaints on this

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score disappeared: in that season the kharif yield for the whole district was only about half the average, and the district was classed as a "famine district." The distress was severe only in the *Jumna-par* tract. The rabi area of 1897 was nearly full in the canal tracts, but fell seriously in the *kurka* and *Jumna-par* regions: the yield was however good, and the distress was not prolonged. Cultivation recovered at once in the following year.

Between 1898 and 1902 the only adverse event recorded was somewhat serious damage caused by rust to the wheat crop in the wet season of 1900-01. The seasonal yields since 1903 are given in the following table:—

Year.	Rabi.				Kharif.			
	All crops.	Wheat.	Gram.	Poppy.	All crops.	Juar.	Bajra.	Cotton.
1903 ...	100	100	88	100	69	69	56	69
1904 ...	94	100	100	94	81	94	94	81
1905 ...	68	62	87	87	74	69	75	100
1906 ...	72	75	69	75	107	125	125	100
1907 ...	79	50	94	94	56	37	44	55
1908 ...	81	87	75	81	92	100	100	81
1909 ...	90	87	94	94	87	81	100	69
1910 ...	100	100	100	94	91	62	87	100
1911 ...	97	94	100	44	...	...	...	...

In 1903, the kharif crops suffered from heavy rain in October; and in 1904 the rain was too heavy in August and too light in September. The exceptional frost of February 1905 affected especially wheat and arhar: and in the same season linseed suffered from rust and rape from the aphis. The rains this year were late and were throughout inadequate: the crops were almost complete failures in the *Jumna-par* tract and along the Sengar. The rabi area of 1906 fell by 20 per cent., and the yield was very bad in the same tracts. In February the Jumna and Chambal rivers rose and destroyed the crops

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in their lowlands. Fodder was exceedingly scarce, and the mortality among cattle was heavy. The existence of famine conditions was recognised in March, and works were open till June while gratuitous relief continued through the rains.

The kharif of 1906 was sown on a very large area and gave an excellent yield, and the rabi of 1907 was also satisfactory except that wheat suffered somewhat severely from rust and rape from the aphis. The rains of 1907 were confined to five weeks, and September was entirely dry. Cotton suffered also from boll-worms. The rabi of 1908 was sown on a small area and moisture was insufficient for the unirrigated crops. The areas that suffered most in both seasons were the *Jumna-par* tract, the neighbourhood of the Sengar river, and the east of tahsil Bidhuna. Advances were largely given, and famine was declared in December, when gratuitous relief began. Works were required only from January to May: gratuitous relief was restricted in May and discontinued in August.

In this year the existence of the *baisurai* weed was first reported from tahsil Bidhuna, where it was found to be spreading.

The rains of 1908 secured good crops, but September was too dry for a large rabi area, and tillage was hindered by severe malaria in the autumn. The value of the rabi of 1909 was reduced by rain in April: while in the following kharif cotton was injured by boll-worms and juar by borers. The year 1910 was favourable, but juar was affected by heavy rain in September as well as by borers. The rabi of 1911 was marked by slight rust on wheat, and by very severe injury to the poppy caused by rain in March.

Progress.

The cropped area shows no advance during the last two decades nor does there seem to be any room for expansion. The proportion of remunerative crops is distinctly lower than tion is due to the almost complete disappearance of indigo (which occupied about 50,000 acres), and to a substantial reduction in wheat, which is probably connected with the loss of indigo. Sugarcane is still little sown, but appears to be expanding slightly, and cotton has extended considerably. There was a marked extension of poppy which five years ago covered nearly 20,000 acres, but this is now being reduced. Potatoes are becoming important in a few localities.

The practice of sowing certain kharif crops with the aid of canal-irrigation has extended considerably: in 1898 less than 4,000 acres, were so sown, but in 1910 the area exceeded 34,000 acres and in that year nearly one-third of the maize and cotton, and two-fifths of the fodder, were sown with irrigation.

There has been no important extension of canal-irrigation during the last twenty years, and the maximum area irrigated in years of drought shows no expansion. The number of masonry wells increased largely after the drought of 1905 and is still rising though more slowly: in 1911 there was one such well to 86 acres of normal cultivation as against 104 acres in 1906.

Population expanded between 1891 and 1901, but has fallen sharply in the last decade. Agricultural wages have risen slightly during the last five years, and in 1911 the rates ordinarily paid varied from 2¼ to 2¾ annas.

Loans for land improvement were almost unknown in the decade before 1906, but considerable sums were taken in the two famines, partly for wells and partly for embankments or similar works, and the practice appears to be becoming established on a moderate scale in ordinary years. Advances for other purposes are rarely taken except in adverse seasons when they are popular. There has hitherto been no development of agricultural co-operation.

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No new lines of railway have been opened during the last enty years, and there is only one railway station to 154 iare miles. Various proposals have been put forward for ving the south-east of the district, and a line from khrayan in Cawnpore to Auraiya has been included in the gramme of proposed lines since 1909, but has not yet been ctioned. The mileage of metalled roads has also been dequate, but a great improvement is being effected by the talling of the old Mughal road through the south of the trict.

The rents paid by recorded occupancy tenants have not n appreciably during the last decade : the average rate per e has changed only from Rs. 4·9 to Rs. 5·1 during this iod. Figures for competition rents are available since 3-4, and during this period the rate has risen gradually n Rs. 5·5 to Rs. 6·0 per acre.

The rural industries of the district have as a rule deed, and the loss of indigo has withdrawn a large amount of sonal employment. Glass-making and saltpetre-extraction e however developed. Organised industry is represented by ginning and the pressing mills. The centre of this indusis the headquarters town; formerly it handled a large ount of cotton grown in Gwalior, and it has suffered by erection of ginning and pressing mills in that State. The rict does not derive a large income from external sources, is the income rising appreciably: the sums distributed ually by money-order are about 6½ lakhs at the present e as against six lakhs at the end of the previous decade, a large proportion of this is known to represent local transons.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on weather during the first month of the season counting n the first heavy fall of rain. An early beginning is an

wing to proceed without interruption. If the first month is et, sowings of dry crops will be delayed and the area will fall, ough the loss may be to some extent made good by larger wings of rice (which however is little grown), and also of ıjra, which can be sown until nearly the end of August.

The transplanting of late rice, which covers a much larger ea than the early varieties, requires wet weather in the cond month of the season, and the area will be substantially duced by a long break at this period.

The area planted with sugarcane is influenced by the eather in early spring, at which time rain facilitates tillage: ut it is determined mainly by economic causes. One of these the yields and prices obtained from the crop in recent asons; the other is the financial position of the cultivators, hich depends mainly on the success or failure of the preced- ng harvests.

The area sown with cotton is affected to some extent by e nature of the sowing season; an early start and a dry ason are favourable. The chief factors determining the rea are the profit obtained in recent seasons, and the rela- ive prices of cotton and food-grains.

2. The yield of the early dry crops, of which maize is far e most important, depends mainly on the weather during the rst two months of the season: alternations of rain and right weather are desirable, and the yield may be much duced by excessive rain in the second month. The small rea under early rice requires more rain, and is not likely to ive a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains the middle of September or later: they may be seriously ıjured by heavy falls in the end of September or the begin- ing of October, while they will give very little grain if Sep- ember is altogether dry.

The late rice requires more rain in September than is suitable for the dry crops, and where canal-water cannot be given at least one fall in October is desirable for its complete success.

In the north of the district the area under maize is usually sufficient to assure some supply of food when September is dry: the two southern tracts depend to a dangerous extent on the late millets, but apparently maize cannot be grown successfully in them.

Sugarcane is apt to suffer seriously at two periods. The irst is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most njurious, and rain in October is beneficial. The crop can stand considerable excess of rain, but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive ain: the most dangerous times are probably just after sowing and again at the end of the season. It can withstand fairly ong breaks when once it has made a fair start, and suffers rom a dry September less than any other crop.

3. Apart from variations in the rainfall, the following dangers occur in the kharif season :—

(*a*) The *kachar* land on the Jumna and Chambal may suffer from flood.

(*b*) Cotton may be seriously affected by boll-worms and juar by borers (vide Provincial Note, section VI). A watch should also be kept for other insect-pests.

4. The rabi area depends largely on the rainfall during September and early October. The effects of drought at this eriod are minimised in the areas supplied with canal-water, but the reduction in area is likely to be large in the *kurka* nd *Jumna-par* tracts and also in the dry villages along the Sengar.

5. In ordinary seasons, when the seed-bed has been sufficiently moist, the bulk of the rabi in the *pachar* and the *ghar* can be matured without winter rains: these are however beneficial (within limits) in these tracts, and almost indispensable in the *kurka* and *Jumna-par*. Rain is useful until the early part of February, but the falls should be moderate and of short duration: rain in March or early April will probably do some harm, while prolonged periods of damp and cloudy weather between January and March must be expected to produce rust on wheat. The loss from this cause may be serious, and its extent may not be fully realised till the crop is harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such season must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring early in January will not as a rule do much harm except to arhar. A late frost is likely to cause very severe injury to the staple crops; probably the early days of February are the most dangerous time.

Hailstorms are not important until the cereals are beginning to ear: the danger from them increases as the season dvances.

The rapeseed crop is liable to serious injury from the phis if damp and cloudy weather occurs while the plants are n flower.

The poppy crop suffers severely when damp weather occurs late in the season.

A watch should be kept for the appearance of the potato-h (vide Provincial Note, section VI), which may cause us loss to potato-growers.

The rabi crops in the lowlands may be severely injured pring floods on the Jumna and Chambal, but such floods of very rare occurrence.

7. The area sown with *zaid* crops in ordinary seasons is small: it increases when stocks of food are low and mes an important resource in particular villages.

8. A series of abnormal seasons of one type may pro- certain cumulative effects. After some seasons of defi- t rainfall the water-level falls, and the efficiency of tempo- wells decreases, while the cost and labour of irrigation are erially enhanced. It is possible that the lowering of the er-level may proceed so far as to render the masonry wells ess in some tracts, but this is not known to have occurred. On the other hand a series of wet years may raise the er-level to a point where the productivity of the land de- s. This may happen throughout the district, and should atched for especially in the areas which suffered from erlogging twenty years ago, as the drainage-system may ibly be still inadequate.

9. Distress requiring some measures of relief must be cted to occur when the rains have ceased by the beginning eptember. Its intensity is likely to be greatest in the *ka* and *Jumna-par* tracts, and also in the dry villages g the Sengar. The following measures were taken in 7-8 :—

Revenue suspended, kharif	...	...	1¾ lakhs.
„ „ rabi	...	...	1 lakh.
Revenue remitted, kharif	...	...	¾ „
Improvement loans ...	...	...	⅛ „
Advances for rabi ...	...	...	2¼ lakhs.
Advances for kharif ...	...	...	¾ lakh.

ximum proportion of population relieved 3·0 per cent in ruary.

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areas not commanded by the canals in seasons when the rains iave ceased so early that the large millets wither altogether or are seriously stunted in growth; in this case the only emedy that can be suggested is the importation of grass rom the forest and its distribution on the *takavi*-system. The lemand will depend very largely on the winter rains; if there re none, it may become very great, but even light falls bring p enough grass to keep large numbers of cattle going.

A fodder famine does not necessarily occur when the nillets yield no grain, as the plants may have grown to a ufficient size to yield fodder: but in such seasons juar occasionally becomes poisonous and the loss of cattle due to this ause may be considerable. The poison is formed under the bnormal conditions of growth, and its presence cannot be ecognised beforehand except by analytical method: the only ction possible is to provide advances to enable cultivators to eplace cattle that have died from this cause.

11. Loans for sinking wells should be readily granted n order to improve the water-supply of the tracts where they an be used. It is possible that the system of field embankments may be found useful in the *kurka* and *Jumna-par* racts (vide Provincial Notes, section II).

12. No demand for drainage works exist at present, but series of wet seasons may possibly disclose minor defects, nd these should be watched for.

13. To minimise losses from cattle-disease, attention hould be paid to securing prompt reports of outbreaks under he rules contained in the Land Records Manual, and a ufficient veterinary staff should be maintained to cope with utbreaks where they occur.

It does not appear probable that the ravine systems vhich furnish the grazing-areas in the south of the district will ver be devoted to other purposes, but it is most desirable that ny possible measures should be taken to increase their value astu[illegible], and their improvement (by planting or otherwise) ld be the subject of continued experiment.

14. The district is not well supplied with agricultural al, and for the present at least there is a wide field for *akavi*-system. Improvement loans may be wanted for nry-wells, and also for field embankments if the practice ınd to be desirable. Agricultural loans may be required e following circumstances :—

(*a*) *Early cessation of the rains*. There may be a very large demand to sow the rabi, and possibly also for the following kharif, while smaller sums may be wanted in early spring to plant sugarcane and extend the *zaid* area. Advances for fodder may also be required.

(*b*) *Floods.*—There may be a small demand for money to sow the rabi in places where the kharif has been injured by floods.

(*c*) *Cattle-disease.*—It is important that cultivators should be in a position to replace working-cattle by the beginning of the next tillage-season.

(*d*) *Curtailment of the poppy area.*—It may be desirable to offer advances in villages where the crop has been largely grown in order to enable cultivators to substitute some other remunerative crop.

15. There is at present no effective agency for the introion of agricultural improvements requiring associated ɔn.

As regards cropping, there is room for a better cotton ı available, and also for a better wheat; other varieties of rcane can probably be substituted with advantage in localities, and a leguminous crop is wanted sufficiently ınerative to take a place in the rotation on the better

The cheaper forms of improved tillage-implements should ually come into use, and should assist in controlling the

urai weed (vide Provincial Note, section VIII). The
iency of the sugarcane-mills in use should be examined
if necessary an attempt should be made to introduce
roved types.

DISTRICT NOTE.

CAWNPORE.

[The references are throughout to the tahsils as constituted up to 1911. Statistics for the new arrangement of tahsils are not yet available.]

Topography.

THE surface of the district has usually been described with reference to the rivers, but it should be recognised that the various minor doabs do not constitute homogeneous agricultural tracts.

The Ganges ordinarily flows close to the high bank, and the lowlands are comparatively unimportant, except between Bithur and Cawnpore. In the extreme north-west of the district the Isan, on its way to the Ganges, cuts off a tract of light loam bordered by sand. Leaving these minor areas out of account, the first main sub-division is the Ganges-Pandu doab. The soil along the Ganges bank is sandy or gritty, and that along the Pandu is also light: it passes rapidly into rich loam, but large areas, particularly in the west and centre of the doab, consist of heavy soil with *jhils* and extensive usar plains.

The second duab, lying between the Pandu and the Rind, is generally similar—light soil along the rivers, then loam, with *jhils* and usar-plains, particularly in the west: but the loam is lighter than in the Ganges-Pandu doab.

The third doab lies between the Rind on the north and the Sengar and Jumna on the south. Here too there is some usar in the north-west, but it is not so heavy as in the north of the district. The bulk of the tract is a lightish loam passing into the extensive ravines, but as the Jumna is approached the soils become more of the Bundelkhand type, trees become fewer and in places *kans* may be seen. The south-west portion of the district, lying between the Sengar and the Jumna, is generally similar to the south of this tract, but a considerable portion is occupied by the two converging ravine systems. The area of lowlands along the Jumna is very small: what lowland there is, is as usual very fertile.

Water-supply and drainage.

The Ganges-Pandu doab is watered by the Cawnpore branch canal which commands almost the whole area except the high villages along the Ganges, especially to the east of Cawnpore. Wells can ordinarily be made in this tract as the water-level is fairly high and foundation-clay is met with; but the level falls near the Ganges, and here foundation-clay is frequently absent. Hence such of these villages as do not receive canal water are liable to suffer in drought.

The north-west and centre of the Pandu-Rind doab is watered by distributaries from the Cawnpore branch canal: the south-east was formerly dependent on wells but is now served by the Fatehpur branch canal. Efficient wells can ordinarily be made as the depth to water is not great and foundation-clay is met with. There are dry areas along the Rind, but elsewhere the supply appears to be adequate.

South of the Rind, well-irrigation soon disappears owing to the great depth to water. The Sengar-Jumna doab is served by the Bhognipur branch and the rest of the tract by the Etawah branch with the Ghatampur extensions. These canals serve sufficient areas to make a general loss of crops impossible, but they do not cover the whole ground, and the land not commanded by them is still liable to suffer severely from drought. An attempt has recently been made to demonstrate the protective value of small field-embankments (*bandhiya*) in places where the conditions are apparently suitable, and if these succeed, the extension of the system appears to be the only measure that can be suggested.

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Practically no hostility to well-construction has been reported in this district, but at the recent well-survey the need for more wells was recorded in a large number of villages, particularly in Akbarpur, Cawnpore and Narwal tahsils : construction of wells has proceeded rapidly in the few years for which statistics are available, but is checked by want of capital.

The drainage of the district is generally good: considerable changes have been made in the original alignment of canal channels and obstructions caused by them have been rectified; but no large projects have been undertaken.

Cattle-supply.

The stock of cows in the district is large compared with other districts in the doab; it is to some extent localised in the neighbourhood of the various ravine-systems which afford the principal pasturage. Bulls are usually available for the *desi* cows : the few cows of the Punjab type have not access to bulls of their own breed. Owners are much more interested in making *ghi* than in rearing the young stock. The Makanpur fair is one of the main centres of trade in cattle for a large part of the province : cattle are brought to it from the Punjab, Gwalior, Bundelkhand, and the adjoining districts, and distributed over the lower doab and Oudh. Consquently the stock in the district is very diversified. There does not appear to be any risk of the ravines ceasing to be available as pasture, but breeding would increase if it should prove possible to improve the pasturage.

The district is liable to all the commoner forms of cattle-disease, as might be expected from its position as a collecting and distributing centre; losses from rinderpest are occasionally severe. There is at present no active hostility to the practice of inoculation, but it is not yet welcomed by the people.

Annals.

The district suffered severely in the earlier droughts, but its position has been meterially altered by the construction

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began in 1894 the district was not prosperous. Cultivation had decreased seriously in many villages, mainly in the south, and population had to some extent shifted to the more prosperous parts in the north. The seasons had for some time been unfavourable, the rainfall being as a rule either excessive or badly distributed, and successive losses had gradually impoverished the people. Apart from the poorer villages along the Jumna, depression was reported in 1894-5 in the Ganges-Isan *tarai*, the centre of Ghatampur, and the country round Akbarpur and Bhognipur: in the two last-named localities *kans* was spreading. In 1895 the rains were scanty and ill distributed and the people suffered further losses, while the abrupt cessation of the rains in August 1896 destroyed nearly two-thirds of the kharif crop; the following rabi was sown on a reduced area and much of the outturn was inferior. During this year the district suffered from famine and extensive measures of relief were necessary: the tahsils most affected were Narwal, Ghatampur and Bhognipur.

In 1897 the kharif was sown on a very large area and yielded well: the rabi area of 1398 was however somewhat reduced. During this year it was noticed that the spread of *kans* had been checked, and the wetter parts of the district had been benefited. The Collector, while submitting proposals for the relief of certain villages, wrote as follows: "The famine has done harm to a few villages on the Jumna, but on the whole the succession of dry years may be said to have done more good than harm. The improvement is most marked where there is canal irrigation: fallow is being reclaimed and yielding capital crops, the soil has recovered after the years of rest, spring level has gone down, and there is a brisk demand for irrigation."

The rains of 1899 were at first so heavy that the kharif area was considerably reduced, but a large rabi was sown for 900. The rains of this year were good and a large kharif area gave a good yield. The rabi of 1901 was also good except in the case of wheat, which suffered somewhat seriously from rust. Two favourable seasons followed, but the kharif of 1902 was inferior owing to a prolonged break in August.

The seasonal yields since 1903 are given in the following table :—

Year.		Rabi.				Kharif.			
		All crops.	Wheat.	Barley.	Gram.	All crops.	Juar.	Maize.	Cotton.
1903	...	94	94	94	81	85	87	94	87
1904	...	100	97	97	94	63	62	69	50
1005	...	46	31	44	62	68	50	69	75
1906	...	75	94	79	75	107	119	94	106
1907	...	94	87	94	94	47	25	33	59
1908	...	87	95	95	85	86	87	100	81
1909	...	81	81	81	81	86	78	81	87
1910	...	100	100	100	100	90	81	100	87
1911	..	97	87	100	100	...	...	...	...

The rains of 1903 began nearly a month late, and the harif area was somewhat contracted. Heavy rain in October njured the late crops, but enabled a large rabi area to be own for 1904. The rains of 1904 were heavy and contiuous in July and August, and there was an injurious fall in October. The exceptional frost of 1905 caused very serious njury to the cereals and to arhar. The rains of this year were ery deficient, and all crops suffered. The rabi area of 1906 was restricted by the drought, and the crops suffered from want f moisture, especially in Bhognipur, Ghatampur and parts f Derapur. There was also serious damage by hailstorms. During these seasons distress was felt in Bhognipur and Ghatampur: and in particular there was a severe shortage of odder leading to a reduction in the stock of cattle. Relief works were open from January to June, and gratuitous relief was continued until September, when an excellent kharif crop was assured on a very large area.

The rabi of 1907 was also satisfactory except that wheat suffered somewhat from rust. The rains were however very late and the falls in September were altogether inadequate. The kharif suffered seriously and the rabi of 1908 was sown on a much restricted area : the winter rains were however sufficient and the yield was fair. Test works were opened during the spring but failed to attract labour, and direct relief-measures were limited to a small amount of gratuitous relief, which was discontinued in August.

The rains of 1908 were heavy in August and inadequate in September, especially along the Jumna. Cotton was injured but food-grains did well on the whole. The rabi area of 1909 was restricted owing to the dryness of the ground, and the severe outbreak of malaria, which hindered field-work : rain was insufficient in the winter, but there was considerable damage from hail, and storms at harvest did further harm. The rains were at first very heavy and affected the maize crop, while there were floods on the Ganges. Later in the season the rain was deficient, and rice and juar suffered, while juar was also injured by the borer. It was found possible to sow a large rabi area for 1910, which yielded exceptionally well. The rains of this year were scanty in July and somewhat excessive in September, but the kharif did well, except juar, which was again attacked by borers. The late rain secured a large rabi area for 1911, and the yield was exceptionally good except in the case of wheat which was attacked by rust.

Progress.

There has been no increase in the cropped area. After the depression recorded above it gradually attained a maximum in 1902-3, which was still somewhat below the standard of the previous settlement ; and in the last few years cultivation has fallen slightly below this maximum. There is no

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prospect of any material expansion. The area cropped in each season is subject to substantial fluctuations according to the weather.

The proportion of remunerative crops is low and shows no tendency to expand. The chief change has been the loss of indigo, which has been reduced in the last two decades by about 35,000 acres, and is now of little importance. Wheat and cotton have increased slightly in the same period: sugarcane fluctuates widely and it cannot be said that an increase has been established: poppy has not been of great importance of late years, and is now being reduced. On a smaller scale there has been a marked increase in the cultivation of potatoes and garden crops.

The practice of sowing certain kharif crops early with the aid of canal-irrigation has made substantial progress though less than in the central and upper doab: about one-sixth of the area under maize, cotton and fodder (taken together) is now sown in this way, while twelve years ago the practice was almost unknown.

The canal system has been greatly improved during the last two decades by the construction of the Fatehpur branch and the Ghatampur extensions: tahsils Ghatampur and Narwal have benefited most, but the area protected has increased substantially in Akbarpur, Cawnpore and Bhognipur. Construction of masonry wells has proceeded actively in the same period: accurate statistics are only available from 1906, since when the net number of wells has increased by about 1,300. In 1911 there was one such well to 65 acres of normal cultivation as against 71 acres in 1906.

The census of 1901 showed a substantial increase during the decade, which was most marked in the city and in the tahsils along the Jumna. The last census however shows a serious fall of close on ten per cent; it is common to all tahsils but is more marked in the north-west and centre than in the south and east.

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Cawnpore.

Agricultural wages do not appear to have risen substantially in the last five years, except close to the city; in the rural tracts the rates most commonly paid in 1911 were 2 or 2½ annas.

The practice of taking loans for land improvement, and also for other agricultural purposes, is fairly well established in the district. From 1900 to 1905 the sums taken were small, but they rose rapidly in unfavourable seasons. Close on Rs. 19,000 have been distributed in the last three years in loans for improvements, the popularity of which has increased There has been so far no development of agricultural co-operation.

No new railways have been opened in the past twenty years, but there was in 1911 one station to 91 square miles and the system will be practically complete when the line to Hamirpur and Banda, now under construction, is open for traffic. The road-system is also well developed, the chief recent advance having been the improvement (which is still in progress) of the old Mughal road which crosses south of the district.

The rents of occupancy tenants recorded after the settlement which closed in 1906 gave an average rate of Rs. 4·9 per acre and there have been no material enhancements up to 1911. Competition rents have risen from Rs. 5·5 in 1906-7 to Rs. 5·8 in 1910-11.

The employment offered by the organised industries in the city has increased very greatly during the last twenty years: cotton-mills, woollen-mills and tanneries have all extended while the new industries established include engineering works, sugar-refineries, brush-manufacture and oil-mills. There has been no extension of organised industry beyond the immediate environs of the city. In the rural tracts the closing of indigo-factories has withdrawn a large amount of seasonal employment, and the local textile industry has declined;

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extraction of saltpetre has apparently revived to some extent in the last few years.

The sums distributed annually in the district by money-order have risen during the last decade from about 28 to about 45 lakhs, but a very large proportion belongs to the trade of the city, and so far as is known the rural tracts do not draw a large income from external sources.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of rice, and also of bajra which can be sown until nearly the end of August.

Late rice is planted to a small extent; the area depends mainly on the weather of the second month, which should be wet, and a long break at this period will result in a reduction.

The area planted with sugarcane is influenced by the weather in early spring, at which time rain facilitates tillage but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure or the preceding harvests.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains.

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2. The yield of the early dry crops, of which maize is much the most important, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The small area under early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The late rice requires more rain in September than is suitable for the dry crops, and (where canal-water cannot be given) at least one fall in October is desirable for its complete success.

The cropping in the north of the district is sufficiently varied to ensure a supply of food in ordinarily unfavourable seasons; in the south, where the soils are apparently unsuited to maize, the food-supply is dependent to a dangerous degree on the rainfall of September.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

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3. Apart from variations in the rainfall, the following dangers occur in the kharif season :—

(*a*) Floods may injure the crops in the lowlands of the Ganges and Jumna and along the minor rivers.

(*b*) Juar may be seriously injured by boring insects (vide Provincial Note, section VI).

(*c*) A watch should be kept for insect-pests on other crops, especially cotton and sugarcane.

4. The rabi area depends mainly on the rainfall [of September and early October : the effects of a moderate drought at this period are largely mitigated by irrigation within reach of the canals, but where canal-water cannot be had the fall in area may be very serious.

The area in the Ganges lowlands may be reduced if late floods leave the land unfit for sowing.

5. In all seasons the occurrence of winter rains is important for the success of the rabi, especially in the south of the district. Rain is beneficial up to the early part of February, provided the falls are moderate and of short duration. Rain in March or early April will probably do some harm, while prolonged periods of damp and cloudy weather between January and March must be expected to produce rust on wheat and linseed ; the injury from this cause may be very serious, and its extent may not be fully realised till the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case : a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

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6. Frost early in January will do little harm except to arhar and possibly potatoes: frost at the end of the month or early in February may cause very serious injury to the chief rabi crops.

Hailstorms are not important until the cereals are beginning to ear: the danger from them increases as the season advances.

The rapeseed crop may be seriously injured by the aphis if damp and cloudy weather occurs while the plants are in flower.

The poppy crop may suffer severely from damp weather in March.

A watch should be kept for the potato-moth (vide Provincial Note, section VI), which may cause very great loss to growers.

7. The area sown with *zaid* crops in ordinary years is very small: it increases, but not to a very great extent, when stocks of food have been reduced.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will probably be most noticeable in the lowlands. If the land in the south of the district is affected, the spread of *kans* may cause a rapid decline in cultivation.

9. Distress requiring some measures of relief must be expected to occur if the rains have ceased at the beginning of September. Its severity will depend largely on the financial position of cultivators as determined by previous seasons, but it will probably be relatively greatest in the southern tahsils.

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The following measures were taken in 1907-8 when there was very little need for direct relief :—

Revenue suspended, kharif	1½ lakhs.
" " rabi	⅔ lakh.
Revenue remitted kharif	1⅓ lakhs.
" " rabi	2 "
Improvement loans	¾ lakh.
Advances for rabi	3 lakhs.
" " kharif	1⅛ "

Maximum proportion of population relieved 0·3 per cent in March.

10. A serious shortage of fodder may occur, especially in the south of the district, in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth : in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains : if there are none, it may become very great, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder ; but in such seasons juar occasonally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods ; the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. There is still room for a considerable increase in the number of masonry wells, and loans for this purpose should continue to be readily given. There may be scope for field-embankments in the unirrigated villages in the south of the district (vide Provincial Note, section II).

wet seasons a watch should be kept for any defects that may still exist in this respect.

13. To minimise losses from cattle-disease, attention should be given to securing prompt reports of outbreaks under the rules laid down in the Land Records Manual, and the local veterinary staff should be sufficient to localise outbreaks where they occur.

If it is found possible to improve the pasturage in ravines, special attention should be given to the land along the Sengar and the Jumna in this district.

14. The district is not well supplied with agricultural capital, and for the present at least there is a considerable field for the *takavi*-system. Improvement loans are wanted mainly for sinking masonry wells, but they may also be required for field-embankments. Agricultural loans may be required in the following circumstances:—

(*a*) *Early cessatian of the rains.*—Money may be wanted to a very large amount for sowing the rabi, and probably also for the following kharif: smaller sums may be required in the early spring for planting sugarcane and extending the *zaid* area, while advances to buy fodder may also be needed.

(*b*) *Floods.*—Money may be wanted to sow the rabi in areas where the kharif crops have been injured.

(*c*) *Cattle-disease.*—It is important that cultivators should be in a position to replace working-cattle by the beginning of the next tillage-season.

(*d*) *Curtailment of the poppy area.*—It may be desirable to offer advances in villages where the crop has been largely grown to enable cultivators to substitute some other remunerative crop.

15. There is at present no effective agency for the introduction of agricultural improvements requiring associated action. There is probably room for better varieties of wheat,

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cotton and sugarcane, and also for a leguminous crop sufficiently remunerative to take a place in rotation on the better soils. The cheaper forms of improved tillage-implements should gradually come into use; the tillage of the dry soils in the south of the district requires study to see if improvements are possible in regard to moisture conservation and the control of *kans*.

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DISTRICT NOTE.

FATEHPUR.

Topography.

THE district is divided lengthwise into three tracts, the Ganges, the Central and the Jumna. The limits of these tracts do not coincide with the pargana boundaries, and exact statistics of their area and population are not on record.

The Ganges tract lies in parganas Bindki, Kutia, Gunir, Fatehpur, Kotila and Hathgaon. There is a considerable extent of *tarai* and then a belt of sandy land, often somewhat uneven, up to the watershed, which lies only from three to five miles from the Ganges. The average breadth of this tract is therefore about four miles or roughly one-sixth of the district.

The central tract includes the whole of parganas Haswa and Aya Sah, and parts of all the remaining parganas except Muttaur: it extends over more than half the district. Its cross-section is slightly concave: below the watersheds which bound it on north and south the land is at first a light loam which then gets firmer and passes into clay; *jhils* are large and numerous in the centre, and extensive usar plains are common. Three streams, the Bari Nadi, Chhoti Nadi, and Sasur Khaderi rise in this tract: the two former unite in the west of Ekdala and then fall into the Jumna; the latter lies to the north and passes into Allahabad.

The Jumna tract includes the whole of parganas Muttaur and parts of Kora, Tappa Jar, Ghazipur, Ekdala and Dhata; it forms from one-fourth to one-fifth of the district. The soils are in many places distinctly of the Bhundelkhand type, *kabar* and *parwa* predominating. Ravines are extensive and tend to increase along both the Jumna and its

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tributary the Rind, which joins it in Tappa Jar. There is much less *tarai* on the Jumna than on the Ganges, but what exists is more fertile and less liable to diluvion. *Kans* is found in this tract, but at present does not occupy a large area.

Water-supply and drainage.

In the Ganges tract the *tarai* does not ordinarily require irrigation but is subject to injury from floods. The higher land on the watershed is irrigated from wells, both masonry and temporary, but the slope towards the river is ordinarily unirrigated; the subsoil here is too sandy for temporary wells and foundation-clay is not usually met with.

In the Jumna tract the water-level stands so low that well-irrigation is almost impracticable, and consequently the facts regarding the existence of foundation-clay are not well known. The greater part of this tract is now within the reach of canal water which was made available between 1897 and 1902; the land between the Rind and the Jumna is supplied by the Bhognipur branch canal, while the Fatehpur branch serves the rest. There are however several areas along the edge of the ravines which the canals do not reach, and which are practically unprotected: the largest of these is in the extreme west of the district, being cut off by the Nun Nadi. The higher part of this tract is over-drained and suffers from erosion: the small areas of *tarai* are exposed to injury from untimely floods.

From the point of view of irrigation, the greater part of the central tract may be regarded as divided into two portions by the line of the Bari Nadi. The Fatehpur branch canal, which enters the north-west of the district is carried south parallel to the course of the Rind and then runs between the Bari Nadi and the Jumna until it crosses the former near Asothar. Up to this point the distributaries do not cross the Bari Nadi, which thus marks the northern limit of canal-irrigation. Wells, both masonry and temporary,

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are also possible throughout this southern division, while considerable areas are watered from the *jhils* in Ghazipur and Aya Sah. North of the line of the Bari Nadi wells and *jhils* are the sources of supply. Temporary wells are made almost everywhere: there is practically no hostility to the construction of masonry wells, and their use is spreading, particularly in the eastern parganas; but there is very little capital available in the villages. The analysis of the well-survey of the district is not complete, but over 200 villages have so far been recorded as needing more masonry wells.

The natural drainage of the central tract is defective. The Bari Nadi rises in a group of large *jhils* west of Fatehpur town, and for a considerable distance its channel is ill-defined and obstructed. The same is true of the Chhoti Nadi and Sasur Khaderi, which rise from *jhils* further to the east: and the whole system is unable to carry off the flood-water which accumulates in years of heavy rainfall. Particular areas have benefited by minor drainage works constructed from time to time and projects for more radical improvements have been prepared but have not yet been sanctioned.

Cattle supply.

The stock of cows in the district is relatively much greater than is the case in the central doab; they are to some extent concentrated along the Jumna and the Rind, where the ravines provide a certain amount of grazing, and also along the Ganges. The quality of the cows is moderate, those kept along the Rind being superior to the rest. The supply of bulls is adequate, and the young stock would be much better than they are if they were allowed more milk: but cow-owners are more interested in *ghi* than in calves.

The trade in working cattle is considerable. Dealers from the Punjab bring small numbers of expensive animals; while large numbers of cheap cattle come from Bundelkhand, either for sale in the district or on their way to South Oudh; and local young stock are also exported to Oudh. The market at Fatehpur is the most important centre of trade.

The district is liable to all the common forms of cattle-disease, and losses from rinderpest are periodically serious; this disease appears to be introduced by the cattle coming from Banda when there is an epidemic in Bundelkhand, and from Fatehpur it is distributed over South Oudh. The people were at first very suspicious of the practice of inoculation, but their attitude has changed, and the practice is now welcomed.

Annals.

The annals of the district, as detailed in the annual reports, may be summarized as follows. In 1895 at the end of the series of wet years, the whole district was depressed: exceptional floods in October 1894 caused serious injury to the kharif and also to property in the central tract, and retarded rabi sowings: the rabi of 1895 suffered further from excessive rain in the cold weather, and wheat was affected by rust. Cultivation was decreasing near the *jhils* in the central tract, while *kans* was spreading in the Jumna tract. The rains of 1895 were scanty and ill-timed; the crops were generally poor, and the Jumna tract was noticed as particularly depressed. The failure of the rains in 1896 reduced the kharif outturn to less than one-third of the normal*: and this failure, coming when the district was already depressed induced severe distress. Relief operations were not at first so successful in this district as elsewhere, and for a time the mortality was serious, while very many tenants left the district. The rabi area of 1897 was about two-thirds of an ordinary year, but the outturn was fair, and the need for relief ceased with the rains.

Recovery was, however, not so rapid as in most districts. In 1898 there were several severe hailstorms, and large numbers of cattle were lost owing to an epidemic of

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* By an error in procedure which cannot now be rectified the area returned as cropped in this year excluded all fields on which the crop failed entirely, and the figures for area cannot therefore be compared with those of other years.

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rinderpest; *kans* was reported to be decreasing. The ill distributed rains of 1899 reduced the kharif area, but the yield was fairly good. In this year the extensions of the canal system (the Fatehpur branch and the Ghatampur extension) became effective in places.

In 1900 the kharif area was again restricted by the lateness of the rains, and rice suffered from insufficient rain at the end of the season. The wheat crop of 1901 was severely injured by rust, and there was a destructive hailstorm in the Jumna tract. *Kans* continued to decrease, but the district as a whole had not entirely recovered; the census showed a decrease in population, and in some localities land was lying vacant for want of tenants. In the next two years there were no special calamities and recovery was rapid, though some local floods were reported in the central tract. In 1902-3 the cultivated area at last reached the level of the years before 1895 in almost all parganas.

The seasonal yields since 1903 are given in the following table :—

Year.	Rabi.				Kharif.			
	All crops.	Wheat.	Barley.	Gram.	All crops.	Rice.	Juar.	Cotton.
1903 ...	90	94	94	88	80	87	81	56
1904 ...	94	94	94	84	87	94	87	81
1905 ...	20	12	19	25	62	56	56	75
1906 ...	77	75	81	75	105	125	100	113
1907 ...	88	75	87	94	42	29	40	53
1908 ...	75	87	75	69	90	100	94	69
1909 ...	90	87	87	94	84	81	75	100
1910 ...	100	100	100	100	88	100	69	81
1911 ...	102	87	106	106	...	...	...	...

In 1903 the rains were late and the kharif area was materially reduced: heavy falls in October injured the cotton seriously and millets to a less extent. The year 1904 was

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on the whole favourable though the season was rather too wet for cotton. The frost of January and February 1905 did more harm in this district than almost anywhere else, and a large proportion of the revenue demand had to be remitted. The following rains were late and inadequate throughout; the *jhils* were empty very early and the rabi area of 1906 was reduced. This crop suffered from want of moisture, and there was widespread and severe damage from hail. Remissions of revenue became necessary during these seasons, and test-works were opened in the winter but failed to attract labourers.

The rains of 1906 were very favourable and there was an excellent kharif: the following rabi too was good except for injury to wheat caused by rust. The rains of 1907 began very late, and there was hardly any rain after August. The areas most affected were the heavy rice-soils in the central tract and the dry villages along the Jumna. Large sums were distributed as *takavi* to get rabi sown for 1908 and a surprisingly large proportion of the normal area was sown, but the dry crops suffered from lack of moisture. During these seasons village and aided relief-works had to be opened and gratuitous relief was given until August.

In 1908 the rains were favourable until September, when they were insufficient: cotton however was injured by too much rain in the early part of the season. The rabi area of 1909 was restricted by want of moisture and by the severe outbreak of malaria which prevented field-work. Some damage was done by heavy rain at harvest time. The rains were favourable on the whole, but insufficient for the rice-crop; and juar was seriously injured by borers. Moisture was sufficient for sowing practically a full rabi area for 1910, and the yield was exceptionally good. There was however a severe outbreak of rinderpest during this year, and losses of plough-cattle were heavy. The rains of 1910 were favourable until the end of September when cotton and millets were injured:

ır was also again injured by borers. Rinderpest continued
nearly the close of the year. The rabi of 1911 was sown
an exceptionally large area, and would have been excellent
t for rust on wheat and blight on poppy.

Progress.

In the matter of cropping the district has remained
actically unchanged throughout the last two decades. There
s been no extension of cultivation: the area cropped fell
between 1894 and 1900, but since 1901 the former level
s been regained, and there is apparently no room for future
pansion.

The proportion of remunerative crops is very low, and
ows no tendency to rise. Wheat fell in the period of distress
t has regained the former level: cotton shows a slight
ndency to expand: sugarcane promised to extend along the
nal, but the promise has not been made good: while the
ppy area is now being reduced. Some varieties of rice are
own for rent-paying, but the area under them cannot be
tinguished from that where rice is grown for food. Among
d crops, maize is apparently extending though the area is
l very small.

The position of the southern half of the district has been
olutionised by the introduction of canal water between
98 and 1902. Construction of masonry wells has proceeded
wly of late, the number having risen by about 700 since
05; there was in 1911 one such well to 38 acres of normal
tivation as against 40 acres in 1905. No material progress
s been made towards improving the drainage of the central
ct.

The district shows a small but steady decrease in popula-
n since 1891, but the distribution of this has been unequal;
each census the northern half of the district has declined,
ile the south has either increased or declined to a less
ent, and in 1911 tahsil Ghazipur alone shows an increase.

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Agricultural wages have been almost unchanged during the last five years, but there is apparently a tendency to rise in a few localities. The rates paid in 1911 varied between 1½ and 2¼ annas.

The district appears to be unusually short of agricultural capital owing to the poor circumstances of the bulk of the landholders. Advances for temporary wells are readily taken in unfavourable seasons, and their offer should be a most important part of the functions of the administration. Substantial sums were taken as advances for land-improvement in the famine of 1896, but for several years afterwards practically no loans were made. Of late years rather more has been taken: but progress is slow having regard to the need of capital for more masonry wells established by the well-survey. Agricultural co-operation has made a satisfactory start: in 1911 there were 24 rural credit societies with working capital of over Rs. 34,000, financed mainly by the Fatehpur district bank.

N railways have been opened in the district during the past twenty years: the number of stations on the East Indian Railway has been increased in this period, and there is now one station to 182 square miles. This proportion is low, but the configuration of the district does not suggest the need for further construction. The mileage of metalled roads is exceptionally high, and has been increased in the same period only by the construction of short lengths of feeder-roads.

The movement of rents during the last two decades has been very small. There has been no general enhancement of the rent of recorded occupancy tenants and the average rate paid by them has risen only from Rs. 4·4 to Rs. 4·6 per acre; while competition rents have risen from Rs. 4·1 to Rs. 4·8.

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There are no industries organised on modern lines in
e district : indigenous industries are of little importance, and
ve as a rule declined.

The external income of the district is not great : the sums
tributed annually in the district by money-order have
en in the last decade from about 5½ to 7½ lakhs, and a
ge proportion of this is known to represent local trans-
ions.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the
ather during the first month of the season counting from the
t heavy fall of rain. An early beginning is an advantage ;
the most important point is that there should be bright
ather with just sufficient rain to enable tillage and sowing
proceed without interruption. If the first month is wet,
vings of dry crops will be reduced, while rice will extend
less the rainfall is very heavy ; there may also be larger
vings of bajra which can be sown until nearly the end of
igust.

Late rice is planted on an extensive area if the weather
ring the second month of the season is sufficiently wet ;
ong break at this time may result in a large proportion of
land being left fallow.

The area planted with sugarcane is influenced by the
ather in February and March, at which time rain facilitates
age ; but it is determined mainly by economic causes. One
these is the yields and prices obtained from the crop in
ent seasons ; the other is the financial position of the
tivators, which depends mainly on the success or failure
the preceding harvests.

The area sown with cotton is affected to some extent
the nature of the sowing season ; an early start and a dry
ason are favourable. The chief factors determining the
a are the profit obtained in recent seasons, and the relative
ces of cotton and food-grains. Taking a longer view, the

opening of ginning and pressing mills would probably
an extension.

2. The yield of the small area under early dry crops depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more and rather later rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains almost to the end of September; they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The late rice requires more rain in September than is suitable for the dry crops, and, where canal-water cannot be given, at least one fall in October is desirable for its complete success.

The district depends for its food to a dangerous extent on crops that requre rain in September, and a considerable extension of maize would be a great improvement: the crop can probably be grown successfully on the better soils except in the Jumna tract.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand

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fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. Apart from variations in the rainfall, the chief danger to the kharif crops arises from floods which may affect the lowlands on the Ganges and the Jumna, and more seriously a large portion of the central tract, where houses and property are threatened as well as standing crops.

The juar crop may be seriously injured by boring insects (vide Provincial Note, section VI), and a watch should be kept for other insect-pests, especially on cotton.

4. The rabi area depends mainly on the rainfall of September and early October: a late fall will secure an area considerably in excess of the normal, while drought at this period involves a large reduction.

The area in the lowlands may be reduced by late floods leaving the land unfit for tillage.

5. Winter rains are important in all seasons for the success of the rabi crops provided they come by the end of January and that the falls are moderate and of short duration. Rain late in the season will do some harm, while prolonged periods of damp and cloudy weather in January and February must be expected to produce rust on wheat and linseed. The injury from this cause may be very serious, and its extent may not be fully realised till the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost early in January does little harm except to the arhar: at the end of the month it may almost destroy the staple-crops.

Hailstorms are not important until the cereals are beginning to ear; the danger from them increases as the season advances.

The rapeseed crop may be seriously injured by the aphis if damp and cloudy weather occurs while the plants are in flower.

The poppy crop suffers greatly when damp weather occurs late in the season.

7. The area sown with *zaid* crops in ordinary years is very small, but when stocks of food are low it may be trebled or quadrupled and becomes of some local importance.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the lowlands and the lower portion of the central tract. If the tillage of the Jumna tract is hindered in such seasons, *kans* will probably spread and cultivation may fall off to a serious extent.

9. Distress requiring some measures of relief must be expected to occur when the rains have ceased by the beginning of September. Its intensity will depend very largely on the economic position of the cultivators as determined by previous harvests, but the dry portions of the Jumna tract and the heavy rice soils in the central tract will probably be most affected. The following measures were taken in 1907-8, when the need for direct relief was small:—

Revenue suspended,	kharif	1¼ lakhs.
,, ,,	rabi	⅓ lakh.
,, remitted	kharif	1 ,,
,, ,,	rabi	¾ ,,
Improvement loans	... ...	½ ,,
Advances for rabi	... ...	1 ,,
,, ,, kharif	... ...	½ ,,

Maximum proportion of population relieved 2·0 per cent. in March.

10. A serious shortage of fodder may occur, especially in the south of the district, in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains: if there are none, it may become very great, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons juar occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. There is room for a large increase in the number of masonry wells, and improvement loans should be readily granted for this purpose. There is probably scope for constructing field-embankments in the Jumna tract (vide Provincial Note, section II).

12. The drainage of the central tract should be regarded as an urgent matter. Here as has been the case elsewhere the first step should be to improve the defective waterways; until this is done the construction of drains

discharging into those waterways must aggravate the evil further down.

13. To minimise losses from cattle disease, attention should be given to securing prompt reports of outbreaks under the rules contained in the Land Records Manual, and the veterinary staff should be sufficient to localise outbreaks when they occur.

If it is found possible to improve the pasturage in ravine-country, special attention should be devoted to the ravines of the Jumna and Rind.

14. The supply of agricultural capital is entirely inadequate; the need may be gradually met by the extension of the co-operative organisation, the prospects of which are favourable, but for the present there is a wide field for the *takavi*-system. Improvement loans should be readily given for sinking masonry-wells, and efforts should be made to get them taken in the villages where wells are known to be possible and to be required. Loans may also be required for field-embankments if these are found to be desirable and also for embankments in the rice tracts. Agricultural loans may be wanted in the following circumstances:—

(*a*) *Early cessation of the rains.*—A very large sum (exceeding probably what was given in 1907), may be needed to sow the rabi, and a further large sum for the ensuing kharif: small sums may be wanted in early spring to plant sugarcane and extend the *zaid* area, while advances to buy fodder may also be required.

(*b*) *Floods.*—Advances may be required to sow the rabi in villages where the kharif crops have been injured: the need may be urgent in the central tract if the floods have destroyed houses, or if cattle have been lost.

(*c*) *Cattle disease.*—It is important that cultivators should be in a position to replace working-cattle by the beginning of the next tillage-season.

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(d) *Curtailment of the poppy area.*—It may be desirable to offer advances in villages where the crop has been largely grown to enable cultivators to substitute some other remunerative crop.

15. The co-operative organisation is, or will shortly be, a position to carry out agricultural improvements requiring ssociated action.

The district is exceptionally backward and great improve-ents should be possible when capital and other requisites are rovided. In appears possible that more wheat, cotton and ugarcane can be grown, and probably better varieties of these rops are required; while the extension of maize, and the etter utilization of the canal are obvious needs. The tillage f the dry lands in the south of the district requires study ith regard to moisture conservation and the control of *ans.*

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DISTRICT NOTE.

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Topography.

THE district is made up of three distinct portions, the eastern end of the doab, a portion of what is geographically Oudh, and the east of Bundelkhand.

The doab.—This tract lies between the Ganges and the Jumna and includes parganas Kara, Karari, Atharban and Chail. The Ganges *khadir* varies greatly in width, but is in places extensive and fertile; it is however liable to lose its kharif owing to floods, and to be affected by changes in the course of the river: the Jumna *khadir* is of small extent, but is fairly stable. Each river is fringed by an extensive belt of ravines or broken ground, enclosing the central upland: this upland is on the east light loam or sand, and wells are not easily made in it: but towards the west where the upland widens, the centre of it is occupied by stiff loam or clay (a continuation of the central tract in the Fatehpur district), and here wells are usually possible. This land is drained by the Sasur Khaderi, which develops an extensive ravine-system before it falls into the Jumna. The south of the upland differs from the north in having some admixture of the typical Bundelkhand soils, which is seen chiefly in pargana Atharban.

The lowland in the west appears to be adequately drained in ordinary years, but is liable to injury when the rainfall is excessive. *Kans* appears in Chail and Atharban; there is little at present, but ten years ago it covered considerable areas.

The tract is held largely by small landholders who are in many cases thriftless, quarrelsome and indebted, and who rack-rent their tenants.

The *Oudh tract.*—This tract lies north of the Ganges and includes parganas Soron, Nawabganj, Mirzapur, Chauhari, Sikandra, Jhusi, Mah and Kiwai. Most of Mirzapur Chauhari is separate from the rest of the district, lying within the boundary of Partabgarh. The Ganges *khadir* is in places extensive, and is similar to that of the doab: beyond it there is the usual light and inferior soil on the river bank, which gradually becomes better and heavier until in the north and east (parts of parganas Soron, Sikandra, Mah and Kiwai), the country is typical rice-land, large stretches of clay with usar plains and numerous *jhils*. This tract is much more productive than the doab: the cultivators are more numerous and skilful, and the class of crops is better.

The loam is effectively drained: the *jhils* in the north drain ultimately into either the Barna river, which rises in this district, or into tributaries of the Sai.

There are complaints of flooding in wet seasons.

The *Bundelkhand tract.*—This tract includes parganas Arail (or Karchhana), Bara and Meja (or Khairagarh). It is by no means homogeneous and may be sub-divided as follows:—

(*a*) *Ordinary alluvium.*—Nearly the whole of Karchhana, the north of Meja and the northern strip of Bara consist of ordinary alluvium with none of the special features of Bundelkhand; the soil is mainly light loam and the level portions are almost fully irrigated from wells; the villages along the rivers (Jumna, Ganges and Tons) are lighter soil with considerable ravine-systems and in them irrigation is deficient; while there is a belt of clay growing rice under the hills that border the alluvium on the south. On the west of Karchhana the land dips to a clay basin which merges in the *mar* tract of Bara.

(b) *The upland stony tract of Bara.*—This includes more than half the pargana; the soils are thin and poor, and there is little irrigation.

(c) *The* mar *plain in the east of Bara and extending into the clay of Karchhana.*—The predominant soil is *mar* which is productive where properly embanked and cultivated, but is liable to injury in wet seasons. *Kans* is found in the south of this area.

(d) *The centre of Meja, extending from the hills bounding the alluvium to the river Belan.*—The characteristic soils are the stony soil (locally called *bhonta*) along the hills falling to a great stretch of *mar*, mostly of an inferior type, intermixed with smaller areas of *matiar*. The population is scanty, and *kans* is apt to spread.

(e) *The south of Meja extending from the Belan to the Kaimur range.*—The east of this area is similar to the centre of Meja just described. On the west in Tappa Pal there is a tract of rich loam with a denser population: cotton is here one of the staple crops.

Water-supply.

In the doab, the Fatehpur branch canal supplies water in Atharban, the south of Karari and the south-west of Chail, as well as a trifling area in Kara. The records of the well-survey show the conditions regarding well-sinking in each village: broadly speaking wells can be made in the centre of the tract, while on the south the depth to water is too great for irrigation, and on the north foundation-clay is often missing along the Ganges. Masonry wells are numerous except in Atharban, but a very large number of villages were recorded as insufficiently provided; the nature of the proprietary bodies impedes construction, and there is little capital

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available. The water-level appears to have sunk, and a considerable number of old wells have been rendered inefficient in the east of the tract. Irrigation from other sources is not important.

In the Oudh tract, very large areas are irrigated from the *jhils* in ordinary years. Temporary wells are most common in Jhusi, but elsewhere masonry wells are popular and there is no hostility to their construction. There is ordinarily a good supply of water at a moderate depth, but in a considerable number of villages (recorded in detail in the well-survey) foundation-clay is not met with, and in these the wells are inferior. A large number of villages have been recorded in the survey as requiring more wells.

In the Bundelkhand tract, Arail depends mainly on wells, but there is also irrigation from *jhils*. The distribution of foundation-clay is very irregular in this pargana : where it exists masonry wells are popular, but considerable areas depend on temporary percolation-wells. In Bara well-irrigation is important only in the loam tract the ***mar*** is supplied from reservoirs which catch the drainage from the hills, and the supply is sufficient for ordinary years but fails in drought ; the stony tract is dry. The north of Meja is irrigated from wells, the conditions being similar to those of Arail, though with a greater depth to water. The centre and south have very little irrigation beyond supplies from reservoirs, but conditions will be materially changed if the proposed Belan canal is constructed, which is designed to irrigate a large area in this tract. Wells can be made in Tappa Pal in the south-west, but very few exist.

Cattle-supply.

The number of cows in the district is relatively large. There are few in the Oudh tract where a high proportion of the plough-cattle is imported from Bundelkhand and the doab also imports mainly from Bundelkhand, though some western animals are obtained from the Makanpur fair. The largest

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numbers of cows are found in the trans-Jumna tract, especially in Meja; they are not as a rule grouped in large herds, but are owned by large numbers of men who are primarily concerned in making *ghi* and give less attention to the quality of the young stock. The supply of sacred bulls is sufficient generally for the cows, the numbers of which were much reduced by the droughts of the last decade. The centre of the trade is the cattle-market at Karma in Arail, which is visited by dealers from many places including Calcutta.

The district, and especially the Bundelkhand tract, is liable to all the common forms of cattle-disease. The practice of preventive inoculation is now welcomed by the people.

Annals.

Of the period prior to the introduction of annual reports it is sufficient to say that in the Bundelkhand tract the seasons from settlement up to 1886 were favourable. Then followed seasons of excessive and badly distributed rainfall which reduced the cultivation: 1888 was the worst, but this tract did not suffer so much as Banda. From 1889 to 1893 seasons were on the whole favourable.

The year 1894 was exceptionally wet and parts of the western tract of the doab and of pargana Sikandra were injured by floods; the exact localities are not defined in the report, which is silent as regards the Bundelkhand tract, but there is no doubt that the crops there were poor. In 1895 the rain was scanty and ill-distributed and distress appeared in Bara and Meja. In 1896 the early cessation of the rains led to acute famine in these tahsils and also to some extent in Karchhana; there was also distress in the doab, and to a less extent in the Oudh tract. For the whole district the outturn of the kharif was only one-fourth of the normal, and only two-fifths of the usual rabi area were sown for 1897; what was sown on unirrigated land suffered from want of

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winter rain, and the outturn as a whole was about one-half of the normal.

In 1897 favourable rain led to a great improvement in the doab and Oudh tracts: in Bundelkhand the recovery was less rapid and it was not till 1901 that a measure of prosperity returned, the excessive rain in June and July of 1899 and the dry September of the same year having resulted in a reduction in the area sown in both seasons. In the same year troubles about drainage recurred in the north of the Oudh tract, but disputes between proprietors prevented the application of remedies. *Kans* was reported to be generally decreasing. The rabi crops of 1901 were generally good, but there was severe rust on wheat and barley. In the same year the early cessation of the rains injured the rice crop, which is most important in the Oudh tract, but other crops were exceptionally good, and the year 1902 was prosperous.

The seasonal yields since 1903 are given in the following table:—

Year.	Rabi.					Kharif.			
	All crops.	Wheat.	Barley.	Gram.	Linseed.	All crops.	Rice.	Juar.	Cotton.
1903	90	94	94	90	100	76	87	87	50
1904	94	100	94	90	87	81	90	81	75
1905	38	25	31	62	6	80	78	75	50
1906	74	75	75	75	69	89	90	81	87
1907	86	81	87	87	94	29	16	25	31
1908	87	94	94	81	87	86	75	87	87
1909	94	94	94	94	94	94	94	87	95
1910	94	94	94	94	100	89	97	69	85
1911	100	87	94	106	106	...	...	...	...

The rains of 1903 were late in arriving, and excessive falls in October injured cotton and to a less extent juar. A large rabi area was sown for 1904 and was successful though slight damage was caused by hail. The rains of this year were sufficiently heavy in August to damage crops in the lowlands: while falls in October again injured cotton and millets. An exceptionally large area was sown with rabi, but the crops were almost ruined by the exceptional frost of February 1905, and extensive remissions of revenue were required. The following rains began somewhat late, but a very large kharif area was sown in order to replenish stocks: the crops suffered from drought in September and from various insect-pests. Rabi sowings for 1906 were much contracted by the drought and suffered from lack of moisture. Test-works were opened in the Bundelkhand tract in the spring of this year, but direct relief was found to be unnecessary.

The rains of 1906 were favourable, but there were floods on the rivers, and juar suffered from insects. In the rabi of 1907 there were severe hailstorms in Bara and Manjhanpur tahsils necessitating remission of revenue, while wheat was affected by rust, and rapeseed by the aphis. The rains of this year were practically confined to August, and the crops suffered very seriously from the drought of September, while the rabi area of 1908 fell off by nearly 40 per cent. The existence of famine conditions was recognised in Bara and Meja in December and in Karchana in the following month, and regular relief works remained open until June, while gratuitous relief was given in the rest of the district. The mortality among cattle was very high in the Bundelkhand tract.

The rains of 1908 ceased prematurely and the rice crop suffered, while the rabi area of 1909 was still low. This year was however prosperous, and the reports noted the decline of *kans*. The rabi area of 1910 showed a substantial increase, and yielded well; and the following kharif was also satisfactory except for the injury caused by heavy October rain, and by borers to juar. In this season the sugarcane in the

Oudh tract was attacked by the cane-hopper. The October rain followed by a fall in November, gave a full rabi area for 1911, and there was an excellent yield, except in the case of wheat which was affected by rust.

Progress.

There has been no advance in the cropped area of the district taken as a whole. The Oudh tract shows a slight increase during the last two decades but this is only the recovery of ground that had been lost in the wet seasons. In the doab Atharban shows a slight increase, due probably to the canal, but it is counterbalanced by a fall in Chail. In the Bundelkhand tracts the area sown varies so very largely with the season that accurate comparisons are very difficult to draw, but it may be said that the cultivated area at the present time is below the maximum attained about 1892, slightly in Arail, and more markedly in Bara and Meja.

The proportion of remunerative crops is exceedingly low, and shows no sign of advancing. There has been a marked fall in the area under cotton and a slight drop in sugarcane (which however fluctuates greatly), and poppy is now being reduced. On the other hand there has been a distinct extension of sann-hemp in the Oudh tract, whence a considerable export is made to Calcutta, and there are signs of a slight extension of potatoes and garden crops.

In the Oudh tract the construction of masonry wells has proceeded steadily: accurate statistics are available only since 1905, and during this period the number has increased by about 12 per cent: there is now one such well to 29 acres of normal cultivation as against 33 acres in 1905.

In the doab the opening of the canal has greatly improved the area which it commands, ensuring the irrigation of about 20,000 acres in case of need. Well-sinking has been fairly active, the increase since 1905 being about 18 per cent.

In the Bundelkhand tract well-sinking has proceeded satisfactorily in Karchhana and in the well-tracts of Meja but there is still room for many more wells. Reservoirs have also it is understood increased substantially in number, but separate statistics of these are not available for comparison with past years though they are now being recorded.

There has been a distinct fall in the population of the Oudh tract during the last ten years: in the doab there has been a small decrease and in Bundelkhand a nominal increase. In 1911 the population was 1,467,000 as against 1,549,000 in 1891. Rural wages have apparently risen slightly in the Bundelkhand tract during the last five years: they are low and almost stationary in Oudh and the doab.

The district is naturally deficient in agricultural capital, but its borrowings from Government have hitherto been spasmodic. Over two lakhs were taken in the famine of 1895—97, and then very little until 1903—1905 when substantial sums were advanced for special works in the Bundelkhand tract. In 1907-08, over 6½ lakhs were advanced (of which nearly 2½ lakhs were for improvements), and substantial sums have been taken in the last three years. A beginning has been made in agricultural co-operation; in 1911 there were 27 societies at work with 703 members: most of these were financed by the Kara central bank with a working capital of about Rs. 20,000.

The doab and Bundelkhand tracts have not been provided with new lines of railway during the past twenty years; but the communications of the Oudh tract have been transformed in the last decade by the construction of the broad gauge lines to Fyzabad, Jaunpur and Rai Bareli, and the narrow gauge line to Benares. Allowing for additional stations on the older lines, the area per station has been reduced from 317 square miles in 1891 to 84 square miles in 1911. The railway bridge over the Ganges at Paphamau includes a free roadway replacing the ferry which was a serious obstruction to road traffic during the rains. The system of metalled roads is fairly complete; the most recent improvement is the road to Rajapurghat, connecting with the Banda district, which is being gradually metalled.

The rents of recorded occupancy tenants have remained unchanged since statistics became available in 1904-05, the average rate being Rs. 4·6 per acre. In the same period competition-rents have risen only from Rs. 4·1 to Rs. 4·3.

There has been some recent development of organised industry in the city: increased employment has been given by the foundries and printing presses, while flour-mills and a sugar-refinery have been opened. Outside the city the only organised factory is the oil-mill belonging to the East Indian Railway. Minor industries have also developed in the city, especially the manufacture of trunks and boxes. The cessation of indigo-growing has curtailed seasonal employment chiefly in the Oudh tract; indigenous rural industries have as a rule declined.

The sums distributed annually by money-order are large, and have increased during the last decade from about 27½ to about 40 lakhs; it is understood that a large proportion of this income accrues to the city, but a substantial share represents the earnings of inhabitants of the Oudh tract who find temporary employment outside the district.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of rice, and also of bajra and (in Bundelkhand) of til, which can be sown until the end of August.

The area under late rice, which is important in the Oudh tract, depends mainly on the weather of the second month, which should be wet; a long break at this period may cause a considerable reduction in the area planted.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains.

2. The yield of the early dry crops, chiefly small millets, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more and later rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry. Continuous rain is particularly injurious to these crops in the Bundelkhand tract.

The late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

The district as a whole, and particularly the Bundelkhand tract, depends to a dangerous extent on the prolongation of the rains through September; from this point of view an extension of maize, which is very little grown, would be an improvement, but it is probably unsuited to most of the Bundelkhand soils.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain, the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. Apart from variations in the rainfall, the following dangers threaten the kharif crops:—

(a) *Floods.*—These may occur in the lowlands of the Ganges and Jumna, and also in the west of the doab and the north of the Oudh tract.

(b) *Boring-insects.*—These may cause much injury to the juar crop and also to sugarcane (vide Provincial Note, section VI).

(c) *Cane-hoppers.*—These may be disastrous to the sugarcane crop (vide Provincial Note, section VI).

4. The rabi area depends mainly on the rainfall of September and early October. A late fall of rain leads to a large extension of the area in all three tracts, subject to the exception that if the heavy Bundelkhand soils are already very wet further rain may leave them unfit for cultivation. Continued drought during September and October results in a large reduction of area in all three tracts.

The area in the Ganges lowlands may be greatly reduced if late floods leave the land too wet for tillage.

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5. In all seasons the occurrence of timely winter rains is of much importance for the rabi yield of the district as a whole: their importance is perhaps least in the Oudh tract and greatest in Bundelkhand, but in the latter tract it varies according to the September rainfall; when September has been wet the heavy soils will yield good crops, and the light soils may yield fair crops, with little or no winter rains; while if September has been dry the light soils may yield scarcely anything and the heavy soils an indifferent crop.

Winter rains are valuable up to about the end of January, provided the falls are moderate and of short duration. Rain late in the season will probably do some harm, while prolonged periods of damp and cloudy weather must be expected to produce rust on wheat and linseed (the latter a crop of great importance in Bundelkhand). The loss from rust may be very serious, and its extent may not be fully realised till the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring early in January will do little harm except to arhar: frost towards the end of the month or early in February may almost destroy the cereals and linseed and cause great injury to all other crops.

Hailstorms are not of much importance until the cereals are beginning to ear: the danger from them increases as the season advances.

The rapeseed crop may suffer seriously from the aphis if damp and cloudy weather occurs while the plants are in flower.

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The poppy crop may be seriously injured by damp weather late in the season.

In Bundelkhand the gram crop is liable to injury from caterpillars when the season is wetter than usual.

7. The area sown with *zaid* crops in ordinary years is important in some localities, chiefly in the Oudh tract, but it is not so large as to constitute an important resource for the district as a whole; it increases to a moderate extent when stocks of food are low.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts; their efficiency has recently been much reduced in the east of the doab.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen almost throughout the doab and Oudh tracts, but its effects will be most noticeable in the west of the doab and the north of Oudh. The same conditions will produce more serious effects in the heavier soils of Bundelkhand; these soils cannot be tilled when wet, and if tillage during the rains is hindered less rabi will be sown and an opportunity given for the extension of the *kans*, which in its turn hinders tillage in the following year, and may rapidly occupy a large area of the best land. Any extension of the area rendered unculturable by *kans* should be regarded as a serious symptom. The extension of *kans* may also occur, though probably to a less extent, in the villages lying in the south of the doab.

9. Distress requiring some measures of relief must be expected to occur in seasons when the rains have ceased by

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the beginning of September; its severity will depend largely on the position of cultivators as determined by previous harvests, but it will probably be most widespread in the Bara and Meja tahsils. The following measures were taken in 1907-08.

Revenue suspended, kharif	2¾ lakhs.
" " rabi	½ lakh.
Revenue remitted, kharif	1¾ "
" " rabi	1 "
Improvement loans	2½ lakhs.
Advances for rabi	3 "
" " kharif	1¼ "

Maximum proportion of the population relieved 5·7 per cent. in February.

10. A serious shortage of fodder may occur in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains: if there are none, it may become very great, but even light falls bring up enough grass to keep large numbers of cattle going. The shortage may apparently be felt almost throughout the district, but will probably be most intense in Bundelkhand.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons juar occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal condition of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. The chief measures for improving the water-supply consist in the encouragement of well-sinking in all tracts

where wells are possible. Loans for this purpose should be readily given, and a boring staff should be maintained to assist in the location of sites.

There may be considerable scope for embankments in the rice-country in the north of the Oudh tract (vide Provincial Notes, section III).

Field embankments may be found desirable in the south of the doab, particularly pargana Atharban (vide Provincial Note, section II) as well as in Bundelkhand.

The construction of the Belan canal is most important for the protection of part of Meja.

12. There is at present no demand for drainage works, but the portion in the west of the doab should be considered at the same time as the adjoining tract of Fatehpur, while the north of the Oudh tract will naturally be taken into account in any examination that may be made of the drainage of the Ganges-Gogra doab.

13. To minimise losses from cattle disease, attention should be given to securing prompt reports of outbreaks under the rules laid down in the Land Records Manual, and sufficient veterinary staff should be maintained to localise outbreaks where they occur.

Action does not appear to be required at present to preserve the grazing-grounds in the Bundelkhand tract.

14. Nearly all parts of the district are very inadequately supplied with agricultural capital. The need may be gradually met by the extension of the co-operative organisation, but for the present there is a wide field for the *takavi* system. Improvement loans may be wanted for masonry wells, for field-embankments, and for embankments in the rice-country. Agricultural loans may be required in the following circumstances :—

(*a*) *Early cessation of the rains.*—Advances may be required on a very large scale to sow the rabi, and also for the following kharif, especially in

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Bundelkhand where the rabi area will in any case be small. Smaller sums may be wanted in early spring for planting sugarcane and extending the *zaid* area, and advances may also be required for the purchase of fodder.

(*b*) *Floods.*—Money may be required to sow the rabi in villages where the kharif has been injured.

(*c*) *Cattle-disease.*—It is important that cultivators should be in a position to replace working-cattle by the beginning of the next tillage-season.

(*d*) *Curtailment of the poppy area.*—It may be desirable to offer advances in villages where the crop has been largely grown to enable cultivators to substitute some other remunerative crop.

15. The extension of the co-operative organisation will probably supply an effective agency for introducing in some localities agricultural improvements requiring associated action; and something may also be accomplished through the landholders of one or two estates. The following needs (among others) exist in connection with the cropping of the district :—

(*a*) A more remunerative cotton for Bundelkhand.

(*b*) Better varieties of sugarcane for Oudh.

(*c*) More rust-resistant wheats for Bundelkhand, and better qualities of wheat for the rest of the district.

(*d*) An extension of maize where the crop can be successfully grown.

The study of tillage in Bundelkhand will probably indicate improvements in this direction and in the control of *kans*; the other tracts are suited to the introduction of the cheapest forms of improved implements.

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DISTRICT NOTE.

BANDA.

Topography.

THE first distinction to be drawn is that between the alluvial plain which forms the greater part of the district and the pleateau above the first escarpment of the Vindhyan range which lies on the south-east.

The plateau (known locally as *patha*) is characterized by the thinness of the soil, which has been formed *in situ* from the underlying standstone. The soil is naturally very poor and produces only rice, inferior millets and *til*, while frequent and prolonged fallows are necessary in all but the best places. There is little irrigation, and the tract, while not especially liable to injury from excess of rain, is particularly sensitive to any defect. The population is scanty and depends largely on cattle-raising; the local grasses are fairly good, and resist a moderate drought; but the scarcity of water in the tract makes it usual to drive the cattle down to the Jumna banks for the hot weather. A considerable portion of the area is reserved forest.

This tract includes half of Karwi, about one-fourth of Mau and inconsiderable areas in Badausa.

The plain is divided into two main portions by the river Bagain. The land to the east of this river is very much cut up by the ravine-systems of the streams from the plateau. It consists of a series of narrow doabs, the watershed of which is usually *mar* or *kabar* of moderate quality, while the slopes are *parwa* passing into the *rakar* of the ravine-systems. There is some fair lowland soil along the Jumna. This portion of the district comprises the area of Karwi and Mau below the plateau, most of Kamasin, nearly half Badausa and a small part of Girwan.

The land between the Bagain and the Ken is much less cut up by ravines: in the south the soil is usually *parwa* and *kabar*, while further north there are extensive and fertile *mar* plains passing into lighter soils as the rivers are neared. This tract includes most of Girwan, the north of Badausa, the west of Kamasin, all Baberu, and all Banda and Pailani as far west as the Ken.

Two portions of the district lie beyond the Ken. The west of Banda is much cut up by ravines. The north-west of Pailani has also a large area of ravines in the south, but north of this is a tract of fertile *parwa* resembling the soil of the doab.

Water-supply.

There are a few localities, mostly lying just below the escarpment in Karwi and Badausa, where temporary wells can be made; in the district as a whole either the depth to water is so great (60 to 100 feet), or the subsoil is so unsuitable for cheap wells, that well-irrigation is practically confined to the few fields of garden land to be found in most villages. The rivers flow in such deep channels and the surrounding country is so broken that their water cannot be used directly for irrigation. The Ken canal opened in 1907 serves the doab between the Ken and the Bagain. Projects have been examined for improving the supply in the tract east of the Bagain: the Ohan river has been abandoned as no site can be found for a dam, but it is hoped to utilise the water of the Paisuni.

The supply of moisture is very commonly preserved by field embankments, which prevent erosion and keep the land moist later in the season than would otherwise be possible.

Drainage.

No tracts appear liable to water-logging as the term is used in the doab, but the heavier soils, especially *kabar*, absorb such large quantities of water that their tillage becomes impossible in wet seasons.

Kans.

The following information has been brought together regarding the prevalence of *kans*, which from time to time throws large areas out of cultivation. The weed is always present in the district; even when the plants do not appear the roots in the soil probably retain their vitality, and the seeds are said to be transported by the wind: it may thus appear in any field at any time. Plants once established in a field of good soil soon develop a strong system of roots spreading both downwards and sideways; and unless this tendency is checked at once by careful cultivation it becomes impossible to work a plough in the land. The best chance of preventing the spread of *kans* is to keep the land thoroughly tilled and cropped: hence its spread is most rapid when excessive rainfall during July and August or an early cessation of the rains has prevented the tillage of the heavier fields and shortened the time available for ploughing; a large area must then lie fallow during the cold weather and the *kans* has time to establish itself. When such seasons recur for two or three successive years the *kans* area shows a very rapid extension. Similarly its extension is favoured by any other hindrance to tillage—laziness, poverty, loss of cattle, &c. Once established it occupies the land for several years (said to be from 12 to 20), but eventually dies out, a process said by some authorities to be greatly accelerated by a dry season. *Mar* and *kabar* soils are most likely to be infested with *kans*; it spreads also in the better *parwa*, where however it is more easily eradicated.

Cattle-supply.

The stock of cows all over the district is very large, and there is a considerable surplus production of working animals. As a rule there are not large herds; suitable bulls are very scarce, and much of the milk is taken for *ghi*, so that the young stock are inadequately nourished and of moderate quality. The surplus is bought up by dealers chiefly from South Oudh. On the *patha* there are a few large herds provided with good bulls. The cattle near the Ken approximate to the Kenwaria type, but the home of this breed lies in the States further south, whence working-cattle are imported by those who can afford them.

Rinderpest and foot-and-mouth disease are common in the district, and other diseases also occur from time to time. During the recent severe epidemic of rinderpest the practice of preventive inoculation became popular in the greater part of the district.

Annals.

The settlement of 1881 was made at the end of a run of bad seasons, but the first few years of its currency were favourable and cultivation rose above 1,000,000 acres. From 1885 to 1889, however, the kharif was generally injured by heavy rains in July and August, while a dry September in the last year greatly reduced the rabi area. In 1888-89 the cultivated area stood at 760,258 acres and *kans* had spread widely.

The seasons from 1890 to 1892 were fair, and cultivation was gradually increasing while the *kans* area was being reduced. A change then set in the kharif of 1892 and the rabi of 1893 were both poor; and in 1894 wheat was seriously affected by rust, while the rains were excessive all through the season, and the unusual falls in October caused serious injury to the kharif. In the rabi of 1895 rust was again very severe: the following rains ceased early and there was no rain in the cold weather: both crops were very poor and the district was so distressed that relief measures had to be started. In 1896 a very large kharif area was sown, but the failure of the rains from August onwards caused the loss of most of the crop: the rabi area sown for 1897 was very small and the produce was poor. Acute famine conditions prevailed throughout the

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district during this season, and the percentage of persons relieved to population rose above 42.

In 1897 a fair kharif area was sown and, the yield being good, the period of acute distress terminated, but the district as a whole was still greatly depressed; the rabi area of 1898 was again reduced, and the cultivated area of the year was only 709,040 acres. There was a substantial increase in the rabi of 1899, but progress was checked by excessive rain at the start and drought at the finish of the following monsoon. Cultivation expanded steadily in the years that followed, and in 1902-3 the cultivated area was 866,585 acres.

The seasonal yields since 1903 are given in the following table—

Year.	Rabi.				Kharif.			
	All crops.	Wheat.	Gram.	Linseed.	All crops.	Juar.	Til.	Cotton.
1903 ...	81	81	81	94	84	87	87	35
1904 ...	94	100	100	94	67	62	44	37
1905 ...	57	45	62	20	*	62	62	44
1906 ...	39	56	37	31	111	119	113	113
1907 ...	...	75	100	94	24	31	19	19
1908 ...	65	87	62	65	100	100	94	81
1909 ...	90	90	100	90	87	94	56	100
1910 ...	100	94	100	95	88	75	81	87
1911 ...	109	94	113	110	...	...	...	...

* Figures not available.

The rains of 1903 were late but the falls were favourable until October when heavy rain proved most injurious to cotton, and to a less extent to other crops. This rain however enabled a very large rabi area to be sown for 1904 and the winter rains were favourable. The monsoon was marked by heavy and continuous rain at the start reducing the area sown and injuring the crops, which suffered further from deficiency of rain in September. Good rain fell in October so that a very large area was again sown for the rabi of 1905: the crops promised well until the exceptional frosts of February, when they appeared to be almost destroyed. They recovered to some extent when rain followed the frost, but the damp brought on severe rust on linseed and on *kathia* wheat.

The rains of 1905 set in late but were light at the start and about the usual area was sown: they continued light and irregular and ceased early, and the crops on light soils, and especially in the western tahsils were very poor. The rabi area of 1906 was greatly reduced and (as usually happens when the seed-bed is dry) the *katwa* insect caused much damage to the germinating gram: the winter rains came too late to save the bulk of the crop, and when they came in February there was extensive damage from hail. The whole district was depressed and the existence of famine-conditions was recognised in the western tahsils of Banda and Pailani: relief was provided from March to October, and the works carried out included a large number of most valuable field embankments.

The rains of 1906 enabled a large area to be sown and gave an exceptionally good harvest: there were heavy floods on the Ken and Bagain in September, which caused local injury in the lowlands.

The rabi of 1907 was on the whole good as there was sufficient moisture in the soil to maintain the crops till rain fell in February: wheat however was affected by rust. The monsoon arrived at the end of July and lasted barely a month: the opening of the Ken canal made it possible to secure fair yields in some places but elsewhere the crops were almost an entire failure. The rabi area of 1908 was much reduced, being less than half of the normal, and the *katwa* again did great harm to germinating gram. There was some useful rain in winter and the irrigated tracts yielded fairly well, but the dry crops suffered from lack of moisture. The Karwi sub-division suffered most during these seasons but the whole district was distressed and relief was given from January to July; the calamity was however less severe than in 1897 and the percentage of persons relieved to population barely exceeded 20.

The rains of 1908 were somewhat heavy at the start but a very fair kharif area was sown, and the latter part of the season was favourable. An extended rabi area was sown for 1909 and the winter rains were timely. It was noticed in this year that the *kans* area had fallen very markedly during the dry seasons, amounting to about one-fifth only of what had been recorded in 1901. Rinderpest entered the district from the south and caused very serious losses during this and the following years.

The monsoon of 1909 began early and sowings were again extended. The rain was heavy in July but favourable in the rest of the season: but for some unascertained reason the exceptionally large area of *til* gave a very poor yield. The rabi area of 1910 rose further and with timely winter rains gave a full yield. The following rains were somewhat light in July but heavy in September and October: the kharif area again rose, and most crops were jair but juar was considerably injured by the borer. Rain in November led to a still further extension of the rabi area, and the winter rains were again timely so that an exceptional harvest was secured. The returns of the area occupied by *kans* showed an extension, but this was explained to be due mainly to improved records: the weed was however spreading in some villages of Karwi, Mau and Pailani.

Progress.

Of the last two decades it may be said that the first was one of decline and the second on the whole of recovery. The cultivated area twenty years ago ranged about 900,000 acres; about 1900 it had fallen to 750,000, while it has exceeded 900,000 in each of the last two years, and there is reason to hope that the standard of one million acres may be regained.

The main change in the system of cropping has been the decline in cotton during the last decade: in a sparse population, the amount of labour required by this crop makes it unpopular when prices of food-grains are high. Wheat became unpopular after the rust of 1894 and 1895, but is now extending and linseed also is recovering its position.

There has been no material development of well-irrigation, nor can this be expected to occur, but in other respects the changes of the last few years have been very marked. The Ken canal, opened in 1907, protects the greater part of the Ken-Bagain doab; while over large portions of the district the construction and repair of field-embankments has progressed actively, the work being done in many cases by way of famine-relief.

The census of 1901 showed a heavy fall of population from 706,000 to 631,000. There has been some recovery in the last decade, and in 1911 the population was returned at 657,000.

Rural wages do not appear to have moved appreciably in the last five years, and in 1911 the maximum rate did not exceed two annas.

Advances for land-improvements, principally in the form of field-embankments, have been taken to considerable amounts, and the demand appears to be increasing: in the ten years following the famine of 1897 the demand averaged Rs. 10,500, the highest figure in any year being Rs. 20,000: in 1907-8 close on five lakhs of rupees were given, while in the three succeeding years the average has exceeded Rs. 26,000. Advances for temporary purposes are taken to a large amount even in ordinary years: the smallest annual issue since 1897 was Rs. 10,300 in 1902-3, while the average of recent years (excluding the famine) is more than one lakh.

A beginning has been made in the organisation of agricultural co-operation: in 1911 there were seven large rural credit societies with over 800 members. These have since been reorganised and a central bank has been established at Bargarh; several new societies have been recently registered and a considerable development is expected.

The only development of the railway system since the completion of the Indian Midland line in 1889 has been the opening of some additional stations: in 1911 there was one station to 188 square miles. Substantial improvement will be effected by the opening of the line from Banda to Cawnpore now under construction.

The mileage of metalled roads has been largely increased during the last twenty years, but is still very inadequate, especially in tahsils Kamasin and Mau. An even more urgent need is the provision of bridges, or failing them graded causeways, over the numerous streams that cut the main roads.

Statistics of rents before and after the recent settlement are not directly comparable. During the currency of the previous settlement rent-rates rose to some extent along the railway but not on the black soils or eroded tracts. Since settlement the rents recorded have given a rate of Rs. 2·4 per acre in the case of both occupancy and non-occupancy tenants.

Indigenous industries are of little importance: the chief of them is handloom weaving, which has declined under competition. Modern industry is represented only by a cotton ginning mill at Karwi. Trade at first developed slowly after the opening of the Indian Midland Railway, but it has increased greatly as the district recovered, and considerable quantities of oilseeds, cotton, *ghi*, and in favourable seasons coarse grains are exported. Much of the produce of the north of the district still passes by road to Cawnpore, the trade being largely in the hands of the merchants of Bindki in Fatehpur: this route will probably be replaced to a large extent by the new line to Cawnpore.

The district does not draw a large income from external sources, nor is the income growing. About 1900 the annual distribution in money-orders was about 4 lakhs: it fell to three lakhs between 1903 and 1906, but has been maintained at 4 to 4½ lakhs since the famine.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of bajra and *til* which can be sown until the end of August. Rice, which is important chiefly on the plateau, can be sown in a wetter season than is suitable to the dry crops. There is very little late rice, and sugarcane is not grown.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains.

2. The yield of the early dry crops, principally *kodon* and *sawan*, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops, which give the bulk of the food-supply, require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry. In the heavier soils they may also be injured severely by long periods of wet weather.

Banda.

The food-supply of the district depends to a dangerous extent on the prolongation of the rains, but it is not easy to suggest an improvement in this respect: the heavier soils are almost certainly unsuited to maize, but there may be some room for this crop in the better *parwa.*

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. Apart from variations in the rainfall, the following dangers exist in the kharif season:—

(a) Floods may injure the crops on the small but valuable lowlands of the Jumna, the Ken, and the minor rivers.

(b) The juar crop, the chief staple, may suffer injury from boring-insects (vide Provincial Note, section VI).

(c) The cotton crop is liable to injury from insect-pests, but these have not yet been studied in detail.

4. The rabi area varies within very wide limits according to the rainfall of September and early October. If the rains are prolonged but not heavy at the end the area will probably rise to a very large figure; if they are heavy throughout, the extension on the light soils may be counterbalanced by reduction in the heavier soils; while if they cease early the reduction will be general, but (in moderately bad seasons) proportionately least in the *mar.*

5. In seasons when the ground has been sufficiently wet at sowing-time, winter rains are not essential: without them the heavy soils may yield well, and the light soils moderately. But if the ground has been dry, winter rains are essential to the light soils and most important to the heavy soils. To be of general use the rains should come before the end of January, and a December fall is of special value when the ground is

dry; the falls should be moderate and of short duration. Rain late in the season will probably do some harm, while prolonged periods of damp and cloudy weather in January and February must be expected to produce rust on wheat and linseed, two of the most important crops. The loss from this cause may be very serious (especially to the *kathia* variety of wheat), and its extent may not be fully realised till the crops have been harvested.

6. Frost early in January does little harm, but at the end of the month or early in February it may destroy a large proportion of the staple crops.

Hailstorms are not important until the cereals are beginning to ear: the danger from them increases as the season advances.

The rapeseed crop (where grown) may be seriously injured by the aphis if damp and cloudy weather occurs while the plants are in flower.

The gram crop suffers severely when the seed-bed has been dry from an insect known as *katwa*, which eats through the young shoots shortly after germination.

7. *Zaid* crops are scarcely ever sown.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls; and the efficiency of wells decreases, if they do not fail altogether. This is of only local importance so far as irrigation is concerned, but the failure of the domestic supply may lead to losses of agricultural cattle.

On the other hand a series of wet years may have very serious cumulative results: *kans* must be expected to establish itself and spread rapidly when the tillage of the heavier soils has been prevented by excessive wet, and any extension of the area rendered unculturable by this weed should be regarded as a most serious symptom.

9. Distress requiring some measures of relief must be expected to occur when the rains have ceased at the beginning

of September, but its intensity will depend largely on the economic position of cultivators. The following measures were taken in 1907-8, when direct relief was required on an extensive scale, particularly in the Karwi sub-division.

Revenue remitted, kharif	3⅓ lakhs.
" " rabi	3½ "
Improvement loans	4⅓ "
Advances for rabi	1½ "
" " kharif	2¾ "

Maximum proportion of population relieved 20·3 per cent. in June.

10. A serious shortage of fodder may occur in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains: if there are none, it may become very great, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons juar occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. There is little scope for improving the water-supply by encouraging the construction of masonry wells, but loans for this purpose should be given when they are required. The development of canal-irrigation and the further extension of field-embankments are the most important measures at the present time, while reservoirs should be constructed at any suitable sites that may be found on the *patha*.

12. There is at present no demand for drainage works, and so far as can be foreseen the need is not likely to arise. The district is suffering slowly but surely from the extension of ravines and denudation of the surface-soils; the field-embankments just mentioned are the most practicable palliatives of this process.

13. To minimise losses from cattle-disease, special attention should be given to securing prompt reports of outbreaks under the rules laid down in the Land Records Manual, and sufficient veterinary staff should be maintained to localise outbreaks where they occur.

Any action that may be authorised by Government should be taken to improve the supply of bulls for breeding.

14. The district is exceptionally poor in agricultural capital, and for some time to come there will be a wide field for the *takavi*-system. Improvement loans should continue to be given for field-embankments, the construction of which should be pressed steadily; and they can also be given for wells if required. Agricultural loans may be required in particular in the following circumstances:—

(*a*) *Early cessation of the rains.*—There will be a demand for sowing the rabi, which may be expected to increase in volume as the irrigation-resources are developed; and the demand for sowing the following kharif is likely to be very large, particularly in villages where little rabi has been sown. The experience of 1908 indicates that the poorer cultivators may need further assistance after the kharif is sown in order to enable them to pay for weeding. Advances may also be required to purchase fodder.

(*b*) *Floods.*—There may be a demand for money to sow the rabi from a few villages along the rivers, but it is not likely to be extensive.

(c) *Cattle-disease.*—It is important that cultivators should be in a position to replace working-cattle by the beginning of the next tillage-season.

(d) *Agricultural improvements.*—It is probable (as noted below) that considerable improvements will be found for the irrigated tracts, and advances should be liberally given in consultation with the agricultural department to facilitate the introduction of these.

15. The extension of the co-operative agency appears to give the best chance for the introduction of agricultural improvements requiring associated action.

The study of the Bundelkhand soils may be expected to indicate substantial improvements in methods, especially in regard to conserving moisture and controlling the spread of *kans;* while the introduction of canal-irrigation should be followed by a gradual improvement in the class of crops, a subject which is being studied at the agricultural station at Atarra.

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DISTRICT NOTE.

HAMIRPUR.

Topography.

THE northern half of the district (parganas Hamirpur, Sumerpur, Mandaha, Muskara, Jalalpur, and the north of Rath), is a plain of black soil, broken by ravine-systems near the rivers and drainage lines. It is thus broken up into a series of doabs which present fairly uniform features: the level land near the watershed is good *mar*; as the land falls away the soil changes gradually into inferior *mar*, *kabar* and *parwa* ending in the barren waste of the ravines. Within the ravines there are occasional stretches of lowlying *parwa* and then of alluvial soil.

The ground rises gradually to the south-west and in pargana Rath the *mar* is succeeded first by a fairly uniform belt of soil consisting of an admixture of *kabar* and *parwa*, and then by a level tract of fertile *parwa* which occupies the south of Rath and a small portion of Kulpahar.

The southern tahsils, Mahoba and Kulpahar, contain numerous rocky hills: the main soils are *rakar* and poor *parwa* with occasional blocks of shallow *mar*, but patches of superior irrigated land are found near the village sites; these soils vary in depth according to their distance from the hills.

Water-supply.

The water-supply over the greater part of the district is very defective: indeed when the rains cease early and the winter is dry, there is difficulty in supplying the cattle with drinking-water during the hot weather. Pargana Hamirpur is served in part by a branch from the Betwa canal, which irrigates about 1,200 acres in dry years: and about 2,000 acres can be irrigated from the larger lakes in the southern parganas. The Dhasan canal which has just been opened serves a large part of tahsil Rath and a small area in the north of Kulpahar.

Hamirpur.

Well-irrigation scarcely exists in the north of the district: masonry wells can be made, but the depth to water is so great (varying from 50 to 70 feet) that irrigation is not remunerative. Small tracts are found in Muskara, where temporary wells about 20 feet deep are used, while in the Rath *parwa* such wells are made in considerable numbers. In Mahoba and Panwari-Jaitpur there is a considerable amount of well-irrigation, mainly from masonry wells about 35 feet deep, many of which go down into the underlying rock; but temporary wells are also made in a few localities.

In the north and centre of the district there is consequently not much scope for advances to make wells in dry seasons: in the well-survey only 76 villages were recorded as likely to benefit by such advances. A few villages were recorded in each pargana except Hamirpur where advances for masonry wells would be useful. The survey also brought out clearly the inadequacy of supply in the rock-wells in the southern tract: 120 villages were enumerated in which the wells are sunk to rock and in only eight of these is the supply adequate.

Drainage.

There appear to be no tracts that suffer from defective drainage as the term is understood in the doab, but some of the heavy soils can naturally absorb so much moisture that in wet seasons it turns into a sticky mass that cannot be ploughed. There is little hope that any practicable system of drainage could remove this defect.

Kans.

The following information has been brought together regarding the prevalence of *kans*, which from time to time throws large areas out of cultivation. The weed is always present in the district; even when the plants do not appear the roots in the soil probably retain their vitality, and the seeds are understood to be transported by the wind: it may thus appear in any

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field at any time. Plants once established in a field of good soil soon develop a strong system of roots spreading both downwards and sideways; and unless this tendency is checked at once by careful cultivation it becomes impossible to work a plough in the land. The best chance of preventing the spread of *kans* is to keep the land thoroughly tilled and cropped: hence its spread is most rapid when excessive rainfall during July and August or an early cessation of the rains has prevented the tillage of the heavier fields and shortened the time available for ploughing; a large area must then lie fallow during the cold weather and the *kans* has time to establish itself. When such seasons recur for two or three successive years the *kans* area shows a very rapid extension. Similarly its extension is favoured by any other hindrance to tillage—laziness, poverty, loss of cattle, &c. Once established it occupies the land for several years (said to be from 12 to 20), but eventually dies out, a process said by some authorities to be greatly accelerated by a dry season. *Mar* and *kabar* soils are most likely to be infested with *kans;* it spreads also in the better *parwa*, where however it is more easily eradicated.

Kans was at a maximum just before the settlement of 1880; but the area under it fell in two years from 69,963 to 37,933 acres: the rapid decrease was at the time attributed mainly to the effect of two successive dry seasons. The decrease continued up to 1885; but the following seasons favoured its extension and in 1890 the area was recorded at 76,139 acres. Better seasons then led to a decrease for a year or two; but a rapid development followed, which was checked partially by the drought of 1896. In 1900 when regular returns of this area were first prescribed, over 86,000 acres were recorded as under *kans*. By 1903 this had fallen to about 70,000 acres, and in 1911 to 45,000, the decrease being common to all parganas.

Hamirpur.

Cattle-supply.

The stock of cows in the district is relatively very large: there are practically no large herds managed primarily for breeding, but the cows are owned in small or moderate numbers by men who look principally to the profits of selling *ghi*. The cows are of poor quality and yield little milk, and the calves are as a rule insufficiently nourished. There is plenty of pasturage in ordinary seasons, but losses in years of drought are very heavy. The supply of bulls is very deficient: the practice of dedicating bulls is almost unknown, and mating takes place at haphazard. The surplus stock is sold mainly to dealers from South Oudh. Well-to-do cultivators use imported cattle of better quality, usually brought from the south and west.

Rinderpest and foot-and-mouth disease are common in the district, and black-quarter and haemorrhagic septicaemia also occur. Some progress was made in popularising inoculation during the recent severe epidemic of rinderpest, but in parts of the district the people are still opposed to this practice.

Annals.

Favourable seasons just after the settlement of 1880 led to a period of prosperity which culminated in 1883: then the cultivated area was 858,314 acres. A series of bad seasons set in from 1885 to 1888; the general features were heavy and incessant rain during July and August and an early cessation in September. In such seasons the kharif (particularly cotton) suffers seriously, while the stiffer soils (especially *kabar*) cannot be ploughed for the rabi, which on the other hand suffers from drought in the lighter soils. As the result of these adverse seasons, the cultivated area in 1888-9 was only 690,407 acres, and *kans* had greatly extended: the district as a whole did not suffer severely but individual villages were much affected.

Seasons were fair from 1889 to 1892. The kharif of 1893 was good, but the following rabi was seriously injured by rust. In 1894 the rainfall was very heavy : exceptional falls in October ruined the kharif, and in the following rabi rust was again disastrous to both wheat and linseed : much of the heavier land became waterlogged and cultivation in black-soil fell off seriously. In 1895 the rains were scanty and ill-distributed, and the district suffered from scarcity during the spring of 1896. In this year good rains at the start enabled a large kharif area to be sown, but most of it was lost by the cessation of the rains in August, while the rabi of 1897 occupied only half the area sown in prosperous seasons, and much of it was lost for want of rain. Acute famine conditions prevailed during these seasons and the percentage of persons relieved to population exceeded 25. A large area was sown in the kharif of 1897, and with a good yield the period of acute distress terminated ; the rabi area of 1898 was, however, again greatly restricted and the cultivated area for the whole year (534,747 acres) was the lowest hitherto recorded. The causes that led to the fall were described as follows by the officer deputed to enquire into the settlement :—

" When I came to visit the villages in which the statistics of decrease of cultivation were most startling, I found many where the actual assets were insufficient to pay the revenue. The sole reason to which the decrease in assets can be ascribed is the lack of resources and fall in population by death and emigration in the famine and the years of depression preceding it. In the villages owned by strong cultivating communities and by small resident capitalists the deterioration was comparatively small. In villages owned by large non-resident owners, and in those where the community of sharers were formerly in poor circumstances, it was greatest."

Recovery was checked in 1899 by excessive rain in June and July and drought in September, but from 1900 to 1902 cultivation extended rapidly, and the only calamity recorded during this period was the rust on wheat in 1901.

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A few minor hindrances to agricultural prosperity were noted in the reports summarized above. The most prominent is the loss caused by wild animals: large numbers of deer, which are carefully preserved in the state of Charkhari, do much injury in the villages adjoining the state: pig do damage in parts of Hamirpur near the Jumna ravines; and both pig and deer are found in the centre of Maudaha.

The ravine systems are extensive and from the nature of the case are growing steadily. The loss of culturable land is hardly noticeable during a short period, but in course of time it may be found that the resources of particular villages are seriously diminished through this cause. The seasonal yields since 1903 are given in the following table. :—

Year.	Rabi.					Kharif.			
	All crops.	Wheat.	Barley.	Gram.	Linseed.	All crops.	Juar.	Til.	Cotton.
1903	82	88	85	81	90	80	87	75	75
1904	100	100	100	94	100	56	68	50	50
1905	47	45	50	56	12	50	50	44	44
1906	39	43	45	37	19	102	119	87	94
1907	95	87	95	94	100	23	25	19	19
1908	57	72	80	50	30	79	81	87	69
1909	73	62	62	75	60	86	87	75	87
1910	104	87	113	106	100	63	62	50	50
1911	100	94	110	100	100	...	...	...	...

In 1903 the rabi crops suffered somewhat from deficient winter rain, while cotton and *til* were injured by heavy falls in October. The rabi of 1904 was good, but heavy and continuous rain in July and August followed by drought in September affected all the kharif crops. Rain in November enabled a very large rabi area to be sown for 1905, but very great damage was caused by the exceptional frosts of February, while linseed was also attacked by rust. The rains of this year were

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scanty and ceased prematurely, and the crops withered under hot winds in September. The rabi area of 1906 was very short, and a large portion of the crop had withered before rain came in February. Distress was severe during this season and relief was given on a large scale from February to September: the numbers on relief-works rose above 50,000. There was a very serious scarcity of fodder, and large numbers of cattle died or were sold to be slaughtered.

The rains of 1906 were favourable, and with the aid of large advances for seed and cattle a very large area was sown, the energy shown by the people being remarkable. The yield was exceptionally good, and the rabi of 1907 was also fair, though some localities suffered from defective seed: rust appeared on wheat but caused little injury. The monsoon of 1907 began very late and ceased at the end of August: almost a full area was sown in the kharif but most of it withered, while less than one-third of the normal rabi area was sown for 1908: the irrigated crops did fairly well, but the remainder were much injured by drought and dry winds. Relief measures were again necessary during this season, but large works were not required until March and the distress was less than had been expected, while losses of cattle were not great.

The rains of 1908 were at first heavy while September was somewhat dry: a very large kharif area was sown, but the rabi of 1909 was restricted by the drought and the severe outbreak of malaria that occurred at the close of the rains. This crop suffered from drought before the winter rains, but the south of the district did well owing to a fall in December. The following rains were favourable except for excessive falls in July which interfered with tillage and weeding: and they lasted long enough to enable practically a normal rabi area to be sown for 1910. The winter rains came just when required and the yield was exceptionally good. Rinderpest spread over the district during this year and caused heavy losses. The monsoon of 1910 was at first favourable, but heavy falls in September and October did a great deal of harm to *juar*, *til* and cotton; a large rabi area was however sown for 1911 and yielded well, the only drawback being slight injury to wheat caused by rust. Rinderpest was again severe during this year.

Progress.

The last decade has seen a marked recovery of cultivation, but the area has not yet risen to the standard of the period before depression set in. The class of crops has not improved on the whole: the chief falling off is in cotton which has gone out of favour in the last six or seven years. Wheat declined very much after the losses from rust in 1894 and 1895, but has since expanded, and both *til* and linseed have considerably extended.

In irrigation the great improvement effected has been the construction of the Dhasan canal, which now commands a large area of tahsil Rath. The irrigation-system of the lakes in the south of the district has also been improved, while it is hoped that the changes on the Betwa canal may result in more water being available for pargana Hamirpur. New reservoirs have not been constructed, but plans have been prepared for construction when relief works are next required.

There has also been much activity in recent years in constructing the small field-embankments known as *bandhiyas* which prevent the rainfall from running off the surface of the ground: considerable numbers of these were constructed as relief-works, and construction continues. Some villages have cordially adopted the system, while others still regard it as a suspicious novelty.

The number of masonry wells is increasing slowly in the south of the district, and the deepening of the shallow rock-wells is in progress.

Hamirpur.

The census of 1901 showed a marked fall in population, but there has been a slight recovery in the last decade; the population in 1911 was 465,223 as against 513,720 in 1891.

Cash wages have not risen appreciably during the last decade, but wages paid in grain have risen substantially and are now approximately equivalent to cash rates. The cash wages paid in 1911 varied between 1½ and 2¼ annas.

The district has for many years past taken small sums annually in advances for land-improvement, and the demand is apparently on the increase. Advances for temporary purposes are taken in most years and very large sums are required during or after a period of distress. There has so far been no development of agricultural co-operation.

There has been no extension of the railway system since the line through the south of the district was opened in 1889: but an important development of trade should result from the Cawnpore-Banda line which was begun in 1911. Some progress has made in metalling roads in the west of the district but a connection between Maudaha and Muskara is much needed, and large numbers of bridges could be made with advantage.

Rent-rates show no movement whatever: the average occupancy rate has remained for many years at Rs. 2·7 and the non-occupancy rate at Rs. 2·4.

The only important industries—weaving and dyeing—have it is understood declined considerably. Organised industry is represented only by small cotton-ginning mills at Kulpahar and Mahoba.

The income derived from external sources, as indicated in the statistics of money-orders paid is not of great importance: the sums distributed annually rose very slowly from about three lakhs in 1897-8 to 4¾ lakhs in 1908-9: the last two years however show a sudden increase to 6½ lakhs, due mainly to local transactions.

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Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of *bajra* and *til*, which can be sown until the end of August. The area sown with rice is unimportant. Sugarcane is grown on a small scale in parts of Rath; the area varies partly with the season and partly with the resources of the people.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains. Taking a longer view, the area is affected largely by facilities for marketing, and it appears probable that an increase will follow the opening of the railway.

2. The yield of the early dry crops chiefly kodon and sawan, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The late dry crops, which furnish the main food and fodder supply require the prolongation of the rains almost to the end of September: they may be seriously injured by the heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry. They may be very seriously injured, particularly in the heavier soils, by continuous wet weather between July and September.

The district depends for its food-supply mainly on the prolongation of the rains, and an extension of the area under

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early crops would be an advantage ; but apparently the heavy soils must be regarded as unsuited to these crops.

Cotton is liable to considerable injury from excessive rain : the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. The effects of floods in the kharif season are practically limited to the small areas of lowland along the rivers.

Juar, the staple crop, is liable to serious injury from boring insects (vide Provincial Notes, section VI): cotton is understood to suffer from insects which have not yet been examined in the locality.

4. The rabi area varies within very wide limits according to the rainfall of September and early October. If the rains are prolonged, but not heavy at the end, the area will probably rise to a very high figure : if they are heavy throughout, the extension on the light soils may be counterbalanced by reduction in the heavier soils ; while if they cease early the reduction will be general, but (in moderately bad seasons) proportionately least in the *mar*.

5. In seasons when the ground has been sufficiently wet at sowing time, winter rains are not essential : without them the heavy soils may yield well, and the light soils moderately. But if the ground has been dry, winter rains are essential to the light soils and most important to the heavy soils. To be of general use, the rain should come before the end of January, and a December fall is of special value when the ground is dry : the falls should be moderate and of short duration. Rain late in the season will probably do some harm, while prolonged periods of damp and cloudy weather in January and February must be expected to produce rust on wheat and linseed, two

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of the most important crops. The loss from this cause may be very serious (especially to the *kathia* variety of wheat), and its extent may not be fully realised till the crops are harvested.

6. Frost early in January does little harm, but at the end of the month or early in February it may destroy a large proportion of the staple crops.

Hailstorms are not important until the cereals are beginning to ear: the danger from them increases as the season advances.

The rapeseed crop (where grown) may be seriously injured by the aphis if damp and cloudy weather occurs while the plants are in flower.

The gram crop suffers severely when the seed-bed has been dry from an insect known as *katwa*, which eats through the young shoots shortly after germination.

7. The area sown with *zaid* crops is insignificant.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of wells decreases, if they do not fail altogether. This is only of local importance so far as irrigation is concerned, but the failure of the domestic supply may lead to losses of cattle.

On the other hand a series of wet years may have very serious cumulative results; *kans* must be expected to establish itself and spread rapidly when the tillage of the heavier soils has been prevented by excessive wet, and any extension of the area rendered unculturable by this weed should be regarded as a most serious symptom.

9. Distress requiring some measures of relief must be expected to occur when the rains have ceased at the beginning of September, but its intensity will depend largely on the

economic position of cultivators. The following measures were taken in 1907-8:—

Revenue remitted, kharif	3 lakhs
" " rabi	3½ "
Improvement loans	½ lakh
Advances for rabi	1 "
Advances for kharif	2½ lakhs

Maximum proportion of population relieved 7·9 per cent in May.

A peculiar feature of the district is the difficulty of getting seed after a serious failure of the crops: thus there may be a keen demand for juar in the seed-time following a drought, and for gram when the previous rabi has been poor. Recent experience has shown that—owing largely to the defective communications—private trade does not meet this demand effectively and that a considerable amount of unsound seed is sown. It may be hoped that this difficulty will disappear gradually as communications are improved, but special measures to organise a seed-supply may still be required.

10. A serious shortage of fodder may occur in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains: if there are none, it may become very great, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons juar occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. There is not much scope for well-sinking in the greater part of the district, but loans for this purpose should be readily given where required. A boring staff should be employed for some time to come to assist in locating sites and in sinking pipes to deep springs.

The deepening of the shallow rock-wells in the south of the district should be encouraged in every possible way, and loans for this purpose should be made available. If experience shows that this work is prevented by the occurrence of layers of rock too hard to be pierced by the ordinary methods, arrangements should be made for the supply of dynamite on the lines of the existing arrangement in Jhansi.

The construction of field-embankments should also be pressed on wherever conditions are suitable.

12. There is at present no demand for drainage-works, and so far as can be seen the need is not likely to arise The district is suffering slowly but steadily from the extension of ravines and denudation of the surface-soils, the field-embankments just mentioned are the most practicable palliatives of this process.

13. To minimise losses from cattle-disease, special attention should be given to securing prompt reports of outbreaks under the rules laid down in the Land Records Manual, and sufficient veterinary staff should be maintained to localise outbreaks where they occur. Endeavours should also be made to increase the popularity of the practice of preventive inoculation.

Any action that may be authorised by Government should be taken to improve the supply of bulls for breeding.

14. The district is exceptionally poor in agricultural capital, and there is a wide field for the *takavi*-system. Improvement loans should be readily given for field-embankments, for sinking wells and for deepening wells in the rock,

Hamirpur.

Agricultural loans may be required in particular in the following circumstances :—

(*a*) *Early cessation of the rains.*—There will be a demand for sowing the rabi, which may be expected to increase in volume as the irrigation resources are developed : and the demand for sowing the following kharif is likely to be very large, particularly in villages where little rabi was sown. Advances may also be required to purchase fodder; and possibly small sums can be given with advantage in early spring to secure the maintenance of the area under sugarcane.

(*b*) *Cattle disease.*—It is important that cultivators should be in a position to replace working-cattle by the beginning of the next tillage-season.

(*c*) *Agricultural improvements.*—It is probable (as noted below) that considerable improvements will be found for the irrigated tracts, and advances should be liberally given, in consultation with the agricultural department to facilitate the introduction of these.

15. There is at present no effective agency for the introduction of agricultural improvements requiring associated action.

The study of Bundelkhand soils may be expected to indicate substantial improvements in methods, especially in regard to conserving moisture and controlling the spread of *kans* ; while the introduction of canal-irrigation should be followed by a gradual improvement in the class of crops. The results attained at the agricultural station at Atarra in Banda will probably be in the main applicable to the area watered by the Dhasan canal.

DISTRICT NOTE.

JHANSI.

Topography.

The district is composed of three distinct tracts: (*a*) the northern black soil tract, comprising the whole of Moth and Garotha and the northern parts of Jhansi and Mau: (*b*) the central red-soil tract comprising the southern parts of parganas Jhansi and Mau, the whole of Talbehat and Bansi, and the north of Lalitpur and Banpur: (*c*) the southern black-soil tract, comprising Balabehat, Mahroni and Maraura, and the south of Lalitpur and Banpur. At the edges of these tracts there are transitional villages which contain both red and black soil, and in the southern tract red-soil villages occur in the extreme east, but on the whole the tracts are well defined. In the extreme south the land rises again and rocks replace the black soil, but most of this area is reserved forest or jungle.

The northern black soil tract consists of a series of small doabs: the soil in the centre of these is good *mar*, the well-known black soil: this shades off at each side into inferior *kabar* and then into the ravines of the drainage lines. The proportion of broken or scoured land is high in Mau and Garotha and lower in Moth, though this tahsil has extensive ravines along the Betwa. The injury caused by the scouring of the soil is progressive: the only possible palliative appears to be the construction of field-embankments. Apart from the loss by scouring, the worst features of the *mar* soil are the loss of the kharif crops that results from an excessive monsoon, and its liability to be overrun by *kans*: its best feature is its retentive power, which almost ensures a rabi crop provided a seed-bed can be prepared. The *kabar* cannot be tilled when wet, and it dries so quickly that preparation of the seed-bed is very difficult. Some lighter soil is found in this tract, mainly towards the south. Speaking generally, in years of drought the black soil will yield some kharif but very little rabi as a seed-bed cannot be made.

The central red soil tract is very rocky in configuration and contains stretches of light sandy and gravelly soil, red or yellow in colour, which when unirrigated will only bear the coarsest crops. The water-level is however quite high and consequently wells are very numerous, and the irrigated area (known locally as the *tareta*) is very considerable and grows wheat and barley and occasionally sugarcane, which crops are preceded by maize or small millets. The poor outlying land (called *har*) is only culturable for two or three years consecutively after which it requiries at least an equal period of fallow. In depressions and along the basins of shallow water-courses however careful embanking enables the more laborious cultivators to grow a regular crop of early rice. The surface-conditions in this tract favour the construction of reservoirs formed by embankments across lines of drainage. The large reservoirs are of great value for direct irrigation, but all alike are invaluable in maintaining the supply of water in the wells that lie below them. A special feature of this tract is the value of the grass produced on the uncultivated land. There is a regular trade in this near the railway stations, while in years of drought grass is brought in from the remotest villages.

The southern black-soil tract consists of a more or less undulating stretch of dark soil, cut up by numerous drainage lines bordered by extensive areas of broken ground which is usually covered with jungle. The soil classification recognized locally in this tract differs from that in use in the rest of Bundelkhand: the term *moti* is used to distinguish the better classes of black soil which further north would be described as *mar* and superior *kabar*: *patri* is the scoured sandy or gravelly soil, and the intermediate grades (inferior *kabar*, *parwa* and *rakar moti*) are classed together as *dumat*. The characters of the soils are similar to those in the northern tract.

Water-supply.

There is little irrigation in the black-soil tracts. The Betwa canal runs through a portion of Jhansi and Moth but at a great depth below the surface, and irrigates only a few villages in the latter tahsil. The black soil requires a very large quantity of water to make any difference: the water-level lies very low, and the supply when reached is scanty, so that there is not much scope for well-irrigation. Villages within reach of a supply from reservoirs benefit greatly thereby, but they are for the most part confined to the south of the tract.

In the red-soil tract the wells are numerous but the yield of water is in many cases inadequate, and in dry seasons the supply may fail before the rabi is secured. The most effective protection of this tract is thus to be found in the construction of reservoirs, and of subsidiary canal-systems in the cases where the supply of water is sufficient for these. There is much uncertainty in locating wells in the rock as it is impossible for the people to know whether water will be found and at what depth. Serious obstacles to sinking are presented by the occasional appearance of strata too hard to be blasted with country powder, and arrangements have been made for some years to place the services of an expert dynamite-blaster at the disposal of the people. The red-soil villages which are found south-east of Lalitpur have fewer wells than the main tract.

Jhansi.

Kans.

The spread of *kans* is not a danger to the red-soil tract but in the black soils this weed is a very serious evil. It is always present in the land, and plants once established in good soil rapidly develop a strong system of roots spreading both downwards and sideways: and unless the tendency to spread is checked at once by careful cultivation it becomes impossible to work a plough in the land. The best chance of preventing the spread of the weed is thus to keep the land thoroughly tilled and cropped: hence its spread is most rapid when continuous or excessive rain in July and August, or an early cessation of the rains, has prevented tillage and shortened the time available. The weed establishes itself in the land left fallow, and when such seasons recur in successive years the *kans* area shows a rapid extension. Similarly its extension is favoured by any other hindrance to cultivation such as laziness, poverty or loss of cattle. Once established, it occupies the land for several years, but eventually dies out.

Cattle-supply.

The stock of cows in the district is relatively very large: they are not grouped in large breeding-herds, but are owned in small numbers by very many landholders and cultivators, and are kept primarily for milk. The supply of breeding-bulls is very deficient, and the calves are insufficiently nourished so that their value is low: the working stock is suitable for the red-soil tract and is also exported northwards to the lower doab and South Oudh: the richer cultivators in the black soils prefer to obtain superior bullocks from the south and west. There are two local strains which are superior as working animals to the ordinary produce of the district; one of these is found near Ujhiani on the Betwa in Jhansi tahsil, the other along the Pahuj river.

The district is liable to all the common forms of cattle-disease, and rinderpest is almost always present in some portion of it. During the recent severe outbreak the practice of inoculation became very popular and it is now demanded by owners.

Annals.

The district escaped severe distress in the drought of 1877, and in the early eighties it was prosperous: in 1885 *kans* was reported to have almost disappeared. The monsoons of the following years were usually characterised by heavy rain at the start and an early cessation, and *kans* again extended in the black soils. After a few better seasons came the wet years from 1893 to 1895: the kharif in the black soils was spoilt by the wet, and wheat was very seriously affected by rust in two successive seasons: rabi cultivation was replaced by kharif and *kans* made further progress. The rains of 1895 were abundant at first but ceased in August, preventing rabi sowings: distress became acute in January 1896, the black-soil tracts being most affected, and relief measures were required until the following rains. These were at first favourable, but drought set in at the end of August, and hot winds caused the crops to wither, while little rabi could be sown for 1897. Severe distress ensued, and relief was required from November to the following September.

The following seasons were more favourable, but in 1899 the red-soil tract suffered from the early cessation of the rains, and some relief measures were necessary. In this year the cultivated area of the district fell to 600,000 acres, while over 70,000 acres of land was recorded as under *kans* grass. More favourable seasons followed until 1902, though wheat and linseed were affected by rust in 1901, and recovery was rapid: by 1903 cultivation had risen to 723,000 acres, while *kans* was losing ground. The extended cultivation led to complaints of injury caused by pig and deer to the outlying crops, and licenses were issued for protection, but the fact was recorded that the people do not care to kill deer.

Jhansi.

The seasonal yields since 1903 are given in the following table :—

Year.	Rabi.			Kharif.				
	All crops.	Wheat.	Gram.	All crops.	Juar.	Small millets.	Cotton.	Til.
1903	86	88	88	*95	*100	100	56	100*
1904	100	100	100	50	55	45	35	37
1905	40	62	31	†	50	†	35	35
1906	30	62	13	121	150	94	125	100
1907	106	113	113	25	31	13	25	19
1908	100	100	100	65	69	69	50	50
1909	83	87	81	103	106	106	113	100
1910	100	100	100	97	100	100	84	94
1911	100	94	100	...	...	...	...	...

* These estimates are doubtful. | † Figures not available.

The rains of 1903 began late but were seasonable till October when the falls were abnormal, and caused considerable injury. A large rabi was sown for 1904 and yielded well ; but the rains of this year were unsatisfactory, continuous wet in July and August restricting sowings and injuring the growing crops. The rabi of 1905 was seriously injured by the exceptional frosts of February, and the following rains were deficient almost throughout, so that the kharif yield was poor and the rabi area of 1906 much reduced. This crop too suffered from drought owing to the deficient winter rains, while further injury was done by hail in March. Distress occurred during these seasons and relief was required from January until September.

The rains of 1906 were favourable, and the very large area sown yielded exceptionally well ; the rabi area of 1907 was somewhat restricted, but the yield was again exceptionally good, and the area affected by *kans* was reduced to about one-fifth of the figure recorded in 1900. The rains of 1907 began very late and terminated in August: the kharif area was reduced and the yield was very bad, while only about half the rabi was sown for 1908: good winter rains secured this crop. There was again distress, but famine conditions were recognized only in Garotha and Mau, and the numbers on relief at no time became a large proportion of the population. The relief works carried out included a large number of field-embankments. Rinderpest spread from the south during this year, and losses were heavy.

In 1908 the rains were too heavy at first and deficient in September: the people succeeded in sowing a large kharif area, but the yield was poor: the rabi of 1909 was restricted owing to the drought, but the winter rains were more favourable. The following monsoon arrived early and was favourable almost throughout: and the large rabi area sown for 1910 was successful, except in a few red-soil villages where the wells gave out. The rains were again early, but a prolonged break in July reduced sowings: the rest of the season was favourable and a large area was sown for 1911, which again did well though wheat was slightly affected by rust. The returns for this year showed that the area affected by *kans* had varied little since 1907.

Progress.

Of the last two decades the former was on the whole one of deterioration and the latter of recovery: and the standard of cultivation has returned to about 800,000 acres. The class of crops grown also shows some recovery; pure wheat almost disappeared from the black-soil tracts after the rust of 1894 and 1895 but is now being sown on an increasing scale: the fall in cotton is less than in the rest of Bundelkhand, and oilseeds show considerable expansion.

In regard to the water-supply the chief progress has lain in the recognition of the need for reservoirs in the red soil and field embankments in the black. A large number of sites for reservoirs have been examined and some have been constructed: the most important work is the Garhmau reservoir near Jhansi which is fed by the recently constructed Pahuj canal. Field embankments were made in considerable numbers during the famine, and additions are being gradually made, sometimes with the aid of loans, especially in Moth, Garotha and North Mau; but recent good seasons have resulted in a certain amount of apathy among the people.

The number of masonry wells shows a slow but steady increase, and there is believed to be scope for a considerable addition to the number: while a large number of wells in the rock have been deepened to increase their supply.

Population fell seriously between 1891 and 1901, but the fall has been almost made good in the last decade, and in 1911 the census showed 681,000 souls as against 684,000 in 1891. Agricultural wages have risen since 1906, when they were distinctly lower than in the rest of the division: the rates prevailing in 1911 varied from 1¾ to 2 annas.

There has been a large extension in recent years of the practice of taking advances for land improvement: the advances from 1900 to 1905 aggregated about Rs. 3,000 to Rs. 6,000 yearly, but two lakhs were taken between 1905 and 1908, and the normal figure is now about Rs. 15,000. Advances for temporary purposes are in demand even in ordinary years, and are required to a very large amount in, and just after, unfavourable seasons. Practically no progress has been made towards the introduction of agricultural co-operation: in 1911 there were three small societies in Lalitpur, with inadequate capital and no central financing agency. Development has been hindered by the want of a trained organiser.

There has been no development of the railway system since the completion of the Indian Midland Railway in 1889, the mileage of metalled roads has however been greatly increased especially in the east of Jhansi proper and the

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south-east of Lalitpur. The chief need is for more bridges and causeways over the numerous rivers and streams.

Rents show practically no movement in the district as a whole, the average rent rate for both occupancy and other tenants having been constant for the last six years.

The old industries of weaving and dyeing are much decayed. Modern industry is represented by the railway workshops at Jhansi, which in 1910 employed nearly 3,000 hands: while hay making and baling for despatch afford a large amount of employment, the chief concern in Jhansi having over 800 hands engaged.

The amount distributed in the district by means of money-orders remained almost constant at about seven lakhs from 1898 to 1907: it rose somewhat during the famine and the rise has been maintained. The exact significance of the figures is doubtful, but they do not indicate any large development in the external income of the district.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by large sowings of *bajra* and *til*, which can be sown until nearly the end of August. The small area under rice requires more rain than the dry crops. Sugarcane is grown only to a very small extent.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains.

Jhansi.

2. The yield of the early dry crops depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The small area under early rice requires more rain and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry. In the black soils they are exceptionally liable to injury from continuous rain.

The red-soil tract has a large proportion of the early kharif crops, chiefly kodon and maize, and its food-supply does not depend entirely on the prolongation of the rains, but in the black soils the preponderance of juar makes an early cessation of the rains a very serious evil.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. The kharif crops do not appear to be threatened by floods, and no serious injury from insect-pests has been reported. These should however be watched for specially in the case of cotton and juar.

4. The rabi area varies within wide limits. If September is dry it falls to a very low figure, while rain at the end of September or early in October leads to a large expansion, which however may be checked in the black soils if the weather has been so wet as to prevent tillage.

5. Winter rains are of the utmost importance in all years in the red-soil tracts, and in the black soils when the ground has been dry at seed time. If however these soils

have been thoroughly wet, the rabi on them can be matured without rain. Rain is valuable up to about the end of January, and when the ground has been dry at seed-time a fall in December is of special value. The falls should be moderate and of short duration: prolonged periods of damp and cloudy weather must be expected to produce rust on wheat and linseed. The loss from this cause may be very serious, especially in the case of the *kathia* variety of wheat, and its extent may not be fully realized until the crops are harvested.

6. Frost at the beginning of January is not of great importance, but very serious injury to the wheat and gram may result from frost at the end of the month or in the beginning of February.

Hailstorms do little harm until the cereals are beginning to ear: the damage from them increases as the season advances.

The rapeseed crop is liable to severe injury from the aphis if damp and cloudy weather occurs when the plants are in flower.

7. The area sown with *zaid* crops in ordinary years is very small, and it does not increase materially after unfavourable seasons.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of the wells decreases, while the cost and labour of irrigation are materially enhanced. The lowering of the water-level may proceed so far as to render the masonry wells useless in parts of the red-soil tract, and where this occurs the crops in the *tareta* will be left at the mercy of the weather.

On the other hand a series of wet years or of dry Septembers, after heavy rain, produce the conditions in which the rapid spread of *kans* must be expected to occur.

9. Distress requiring some measures of relief must be expected to occur when the rains have ceased at the beginning

of September. Its intensity will depend largely on the economic position of cultivators, but the northern tract is apparently in most danger. The following measures were taken in 1907-8:—

Revenue remitted, kharif	... 2½ lakhs.
" " rabi	... 1½ lakh.
Improvement loans	... 1 "
Advances for rabi	... 1 "
" for kharif	... 1 "

Maximum proportion of the population relieved 4·0 per cent. in April.

10. A serious shortage of fodder may occur in the black soil areas in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains: if there are none, it may become very great, but even light falls bring up enough grass to keep large numbers of cattle going. The red-soil areas appear likely to have grass to spare in such seasons, unless the drought should be much more severe than any experienced in recent years.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons juar occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognized beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. There is not much scope for well sinking in the black-soil areas, but in the red soils a large development is still possible: more wells can be made, and large numbers of existing wells require to be deepened. Advances for these purposes should be readily given, and the services of the

dynamite-overseer now employed should be retained so long as the demand continues.

The construction of reservoirs in the central tract should be pressed forward until every suitable site has been utilized.

The construction of field embankments, particularly in the northern tract, should be encouraged in every possible way: the suitability of these works for relief purposes is well established and the relief programme should be very largely based on them.

12. There is at present no demand for drainage works, and so far as can be seen the need is not likely to arise. The district, especially the northern tract, is suffering slowly but steadily from the extension of ravines and denudation of the surface soils: the field embankments just referred to are the most practicable palliatives of this process.

13. To minimise losses from cattle disease, special attention should be given to securing prompt reports of outbreaks under the rules laid down in the Land Records Manual, and sufficient veterinary staff should be maintained to localise outbreaks where they occur.

Any action that may be authorized by Government should be taken to improve the supply of bulls for breeding.

There appears to be no danger of the ravines in the northern tract being diverted to other purposes than grazing; but special attention should be given to their improvement if any practical measures to this end are discovered.

14. The district is very poor in agricultural capital, and there is a wide field for the employment of the *takavi*-system. Improvement loans should be readily given both for sinking and deepening wells, and also for field-embankments. Agricultural loans may be required in the following circumstances :—

(a) *Early cessation of the rains.*—There will be a large demand for sowing the rabi, and this may be expected to increase in volume as the supply of water for irrigation increases. There will also be a large demand for the ensuing kharif, particularly in villages where there has been little rabi or where that crop has failed: and advances to buy fodder may also be needed.

(*b*) *Cattle-disease.*—It is important that cultivators should be in a position to replace working-cattle by the beginning of the next wet tillage-season.

(*c*) *Agricultural improvements.*—It is probable that the agricultural department will in time be in a position to recommend considerable changes in the tillage and cropping of the Bundelkhand soils: and advances should be liberally given in consultation with the department to facilitate the introduction of these.

15. There is at present no effective agency for the introduction of agricultural improvements requiring associated action.

The study of Bundelkhand soils and conditions now in progress may be expected to indicate substantial improvements in methods, especially in regard to conserving moisture and controlling the spread of *kans*, as well as introducing new crops and varieties. The greatest need under this latter head is probably for a kind of wheat that will resist rust and be in other respects suitable to the black soil.

DISTRICT NOTE.

JALAUN.

Topography.

THE district is almost surrounded by the Jumna, Betwa and Pahuj rivers. High ground is found close to the beds of these rivers, and thence the land slopes down to the basin of dark soil which forms the bulk of the district. The high ground along the Betwa and Pahuj is usually a hard light soil, much denuded and classed as *parwa* or *rakar*. On the river-side this passes into extensive ravine-systems, which are almost entirely unproductive; below them are disconnected stretches of alluvial land, which is often highly productive but is exposed to risk from untimely floods and deposit of gravel or sand.

The Jumna has similar ravine and alluvial formations but above the ravines there is an extensive plain of productive loam, resembling the doab rather than Bundelkhand. This extends across the north of Jalaun and into the north-west of Kalpi until broken by the ravine-systems connected with the Non river.

Away from the rivers the high ground falls gradually and changes first to *kabar* and then to the *mar* soil which occupies the lowest portion of the basin. The *mar* has the usual characters: it is friable and very retentive of moisture and is highly fertile: but on the other hand it quickly becomes over-saturated: its most valuable crop, wheat, is exceedingly liable to rust; and it is particularly suited to the luxuriant growth of *kans*.

The *kabar* is of two kinds, a darker soil which has more affinity to *mar*, and a lighter variety resembling to some extent inferior *parwa*; the latter is found mainly to the north of the *mar* leading gradually up to the *parwa* tract.

Both kinds are extremely hard and coherent: the dark type is to some extent retentive of moisture but the lighter dries very quickly. If the early rains are heavy the *kabar* cannot be tilled or sown, and heavy rain later is most injurious to the cotton and juar which are the staple crops; while on the cessation of the rains the land hardens rapidly, so that the tillage-season for the rabi is very short, and if the rains cease early sowing is impossible. The central basin is drained by the Non and Malanga rivers, which unite in pargana Kalpi and have cut through the high ground to reach the Jumna. Their lower course is marked by extensive ravine-systems so that a large part of Kalpi is subject to denudation of the surface.

The assessment circles described in the pargana handbooks give the limits of the various tracts: roughly speaking, the basin of dark soils occupies two-thirds of the district, that is most of Kunch and Orai, the south of Jalaun and the west of Kalpi. The pure *parwa* extends over ten per cent. of the district, mainly in the north of Jalaun: while over twenty per cent. consists of the watersheds, ravines and alluvial land found in all parganas.

Water-supply.

The water-level in the greater part of the district is too low for well-irrigation, which (except in the *parwa*) is practised only for garden or special crops. Unprotected wells can be dug in parts of the *parwa* tract, but on the whole wells are little used. *Jhil* and river irrigation is almost non-existent, and the only important source of irrigation in the district is the Betwa canal. Its two branches run along the high ground parallel to the Betwa and the Pahuj and send off distributaries into the central plain: but the western or Kathaund branch turns eastwards parallel to the Jumna and waters the greater part of the *parwa* tract.

Cattle-supply.

The stock of cows in the district is proportionately greater than in the doab, but much below that of the other districts of

Bundelkhand, and it has been for the time being seriously reduced by the losses suffered in recent droughts. The cows are kept primarily for milk, and the share left for the calves is usually quite inadequate. The cows are not grouped in large herds, but are owned by landholders and cultivators: the practice of dedicating sacred bulls is rarely followed, and the quality of the available bulls is most inferior. The young stock are of low quality, and considerable numbers of them are exported to South Oudh and as far as Benares: while those cultivators who can afford it import stronger animals from the states on the south and west. In 1911 the stock of plough-cattle was reported to be insufficient for the proper tillage of the district.

The district is liable to all the common forms of cattle disease, and rinderpest causes very heavy mortality from time to time. The people are still suspicious of the practice of inoculation, though a little progress has been made towards securing its acceptance.

Annals.

The district as a whole was fairly prosperous about 1884, but a period of depression began in 1885 and lasted almost until the close of the century. The first land to suffer was the *kabar*: in four successive seasons from 1885 to 1888 there was heavy and continuous rain during July and August, interfering with sowings and causing serious damage to such juar and cotton as was sown; while in two of the four seasons September was dry and the rabi area was short. By 1889 the *kabar* was seriously deteriorated, and though the seasons up to 1893 were more favourable there was no material improvement. The other soils had fared better during this period; comparatively little kharif is sown in the *mar*, while the *parwa* and *rakar* are not liable to over-saturation. In 1893 however the deterioration of the *mar* began with a most destructive hailstorm: while the heavy monsoon rains of 1893 and 1894 favoured the spread of *kans* by hindering rabi sowings, and excessive winter rains caused severe rust on wheat in 1894 and on wheat and linseed in 1895.

In 1895 the rains were light and ceased early: and with poor kharif crops and a reduced rabi area for 1896 distress became apparent and relief measures were required from January to July. The monsoon of 1896 was light and ceased in August; the kharif yield was less than 30 per cent. of the normal; only about one-third of the usual rabi area could be sown for 1897 and its yield was very poor. Distress was severe and general during these seasons, and the percentage of relieved to population rose to 34·8.

The following seasons were of moderate quality: there were no failures and no exceptionally good crops: in 1901 severe rust was again brought on by excessive winter rains. In 1902 some diminution of the *kans* area was reported. During these years there had been repeated reductions of revenue, while the Alienation of Land Act and the Encumbered Estates Act were being brought into operation, and the new settlement made shortly afterwards was based on the recognition of the need for periodic adjustments of revenue according to the extent of cultivation. The settlement officer in reviewing the period that has been described wrote as follows:—

"The principal feature of the period under report is the remarkable rapidity with which deterioration set in and spread. The sole cause is not to be found in the unpropitious seasons. In reality other factors such as the nature of the soils, the scantiness of the population, the character of the people, and the severity of the assessment played a large part. Distress runs through certain clearly recognisable stages. In the first, rents only are affected; in the second, cultivation. If not acute, and confined to a single season, it is marked only by heavy arrears of rent which are rarely recoverable. If continued, the non-resident tenant throws up his holding while the resident abandons his inferior fields. With resources thus weakened, the proprietor can neither assist the tenant nor maintain his own cultivation : his cattle die and he is unable to replace them : his credit fails and he can get no seed, and he too abandons the whole or part of his holding. Too often he mortgages his property and is sold up by a non-agriculturist. The result is that considerable areas fall out of cultivation : *kans* springs up in the fallow, and once firmly rooted, spreads irresistibly and lays waste the cultivated fields. This has been the history of village after village in the worst affected parts of the district.

"I merely repeat what each of my predecessors in one form or another has placed on record, viz. that the prosperity of the district is bound up with the existence of strong solvent village communities : so long as they remain in tact, a succession of unfavourable seasons leaves no permanent ill effect and is forgotten in the next good harvest : once they are broken up and dispersed, recovery, even with good years, is a slow and gradual process."

The seasonal yields since 1903 are given in the following table :—

Year.		Rabi.				Kharif.			
		All crops.	Wheat.	Gram.	Linseed.	All crops.	Juar.	Bajra.	Cotton.
1903	...	*	88	75	90	...	81	55	62
1904	...	*	96	96	94	25	25	20	31
1905	...	34	37	37	13	...	30	25	19
1906	...	29	37	25	19	107	131	110	119
1907	...	99	100	100	75	25	18	18	30
1908	...	50	62	37	43	82	75	95	81
1909	...	83	69	87	81	94	87	100	94
1910	...	100	100	100	100	83	75	81	56
1911	...	105	94	106	125	...	...	...	...

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*Figures for areas under particular crops not available.

followed but the rains of 1904 were of almost the worst type—excessive at first and deficient later. The following rabi felt the full effects of the exceptional frosts of the first days of February, and the monsoon was inadequate throughout, giving a very bad kharif yield and a reduced rabi area for 1906. This crop too suffered severely from drought. Distress was acute during this season and relief measures on a large scale were required until the succeeding kharif was assured. A particular feature of the year was the extreme scarcity of fodder: the autumn crops had not yielded even stalks, and very little grass survived September. Hay was imported in large quantities from the forests, but cattle were sold for slaughtering in great numbers.

The kharif of 1906 was sown on an exceptionally large area and yielded an extraordinarily abundant crop, so that labour could scarcely be had for the harvest: the rabi area of 1907 was almost normal and the yield good, rust—which prevailed in the doab—doing little harm. The rains of 1907 were however a failure: they began so late that sowings were restricted, and they failed in September. The rabi area of 1908 was hardly more than one-fourth of the normal: the winter rains were late but copious, and despite high winds in March the yield was appreciable. Distress was again severe and relief measures were required from December to August, the percentage of relieved to population rising to 20·7.

The rains of 1908 enabled a large kharif area to be sown, but August was too wet, and September too dry, for the crops. The rabi area of 1909 was still low, owing partly to lack of moisture and partly to the severe outbreak of malaria which hampered field work. Wheat was a poor crop, owing largely it is understood to inadequate tillage. Rinderpest was widely prevalent during these seasons. The following kharif was ptember enabled a very large rabi area to be sown for 1910. e winter rains came just when wanted and there were no uries to the crops. The rains of 1910 were heavy and the arif area was moderate : the crops promised well until the essive rain of October which did much harm to cotton and o injured the millets. The rabi area of 1911 was again ge : damp weather late in the season brought out some rust wheat but the yield all round was exceptionally good. The tistics for the last two years show a rapid extension of the a covered by *kans* and in 1911 the Collector reported that s is due to the scarcity of cultivators and cattle. The crease of pig was also reported in Kalpi.

Progress.

The variations in the cultivated area are so great that s difficult to detect a definite expansion or contraction. e standard about 1885 may be taken at about 600,000 res, and in 1893 at about 560,000 acres.

In the exceptional year 1906-7 cultivation reached almost 0,000 acres and in 1909-10 it exceeded 560,000 acres : it thus somewhat below what has been attained in the past ough the last decade has on the whole been one of recovery. e proportion of the area devoted to remunerative crops s on the whole varied little : the area under cotton has clined, but there is a tendency to extend the wheat area and so oilseeds.

The facilities for canal-irrigation have been greatly proved during the last ten years, which have seen a large crease in the capacity of the Parichha weir and the addition a second weir at Dukwan, as well as considerable improve- ent in the alignments of the channels. In 1905-6 the nal irrigated over 110,000 acres, a figure much above any

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watered, owing to some extent to inadequate supplies. In ordinary seasons the canal is much more widely used than was the case ten years ago.

Of late years some progress has been made in the construction of small embankments to retain the rainfall instead of allowing it to run off: over 40 such works were constructed during 1907-8 either as aided relief-works or with the help of advances.

The population of the district has expanded very slightly during the last twenty years, and in 1911 stood at 405,000 as compared with 396,000 in 1891.

Rural wages have not risen appreciably in the last decade; the rates recorded in 1911 varied from 2 to 2¼ annas but considerably higher rates may have to be paid to secure labour at harvest time.

Advances for land improvement have in the past been taken on a moderate scale in ordinary years; the demand has apparently increased since the famine of 1905-6. Advances for temporary purposes are made even in ordinary years, and are taken on a very large scale in and after unfavourable seasons.

A beginning has been made in organising agricultural co-operation: in 1911 there were 14 rural credit societies with over 300 members, financed by the district bank: an extension of the organisation is expected.

The railway was opened through the district in 1889, and the branch line to Kunch in 1905, but the desired extension northwards toward Madhogarh has not yet been undertaken. In 1911 there was one station to 163 square miles, but the northern and most productive part of the district is still a long distance from the railway. The length of metalled roads has been increased from 95 to 139 miles during the last twenty years, and no important extensions are contemplated.

The only important rural industry—that of weaving—has or long been decaying: organised industry is represented by our cotton-ginning mills, which however have recently had lifficulty in obtaining sufficient raw material.

The district does not apparently draw a large income rom external sources: the sums distributed by money-order verage about 3½ lakhs yearly at the present time, and such ncrease as has occurred in the last decade can be accounted or by the extension of local transactions.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on he weather during the first month of the season counting rom the first heavy fall of rain. An early beginning is an dvantage, but the most important point is that there should e bright weather with just sufficient rain to enable tillage nd sowing to proceed without interruption. If the first nonth is wet, sowings of dry crops will be delayed and the rea will fall, though the loss may be to some extent made good by larger sowings of bajra and til, which can be sown ntil the end of August. The area under rice and sugarcane is trifling.

The area sown with cotton is affected to some extent by he nature of the sowing season; an early start and a dry eason are favourable. The chief factors determining the rea are the profit obtained in recent seasons, and the relative prices of cotton and food grains.

2. The yield of the early dry crops (that is the small nillets, maize being almost unknown) depends mainly on the veather during the first two months of the season: alternaions of rain and bright weather are desirable, and the yield nay be much reduced by excessive rain in the second month.

fodder supply, require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry. They may also be very seriously injured, particularly in the heavier soils, by continuous wet weather between July and September.

The district depends for its food-supply mainly on the prolongation of the rains, and an extension of the area under early crops would be an advantage, but apparently the heavy soils must be regarded as unsuited to these crops.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. The effects of floods in the kharif season are practically limited to the small areas of lowland along the rivers.

Juar, the staple crop, is liable to serious injury from boring insects (vide Provincial Notes, section VI): cotton also suffers from various insect-pests.

4. The rabi area varies within very wide limits according to the rainfall of September and early October. If the rains are prolonged, but not heavy at the end, the area will probably rise to a very high figure: if they are heavy throughout, the extension on the light soils may be counterbalanced by reduction in the heavier soils; while if they cease early the reduction will be general, but (in moderately bad seasons) proportionately least in the *mar*.

5. In seasons when the ground has been sufficiently wet at sowing-time, winter rains are desirable but not essential: without them the heavy soils may yield well, and the light

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soils moderately. But if the ground has been dry, winter rains are essential to the light soils and most important to the heavy soils. To be of general use, the rains should come before the end of January, and a December fall is of special value when the ground is dry: the falls should be moderate and of short duration. Rain late in the season will probably do some harm, while prolonged periods of damp and cloudy weather in January and February must be expected to produce rust on wheat and linseed, two of the most important crops. The loss from this cause may be very serious (especially to the *kathia* variety of wheat), and its extent may not be fully realised till the crops are harvested.

6. Frost early in January does little harm, but at the end of the month or early in February it may destroy a large proportion of the staple crops.

Hailstorms are not important until the cereals are beginning to ear: the danger from them increases as the season advances.

The rapeseed crop (where grown) may be seriously injured by the aphis if damp and cloudy weather occurs while the plants are in flower.

The gram crop suffers severely when the seed-bed has been dry from an insect known as *katwa*, which eats through the young shoots shortly after germination.

7. The area sown with *zaid* crops is insignificant.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of wells decreases, if they do not fail altogether. This is only of local importance so far as irrigation is concerned, but the failure of the domestic supply may lead to losses of cattle.

On the other hand a series of wet years may have very serious cumulative results: *kans* must be expected to establish itself and spread rapidly when the tillage of the heavier soils has been prevented by excessive wet, and any extension of the area rendered unculturable by this weed should be regarded as a most serious symptom.

9. Distress requiring some measures of relief must be expected to occur when the rains have ceased at the beginning of September: its intensity will depend largely on the economic position of the cultivators, but the Kalpi tahsil appears likely to suffer most. The following measures were taken in 1907-8:—

Revenue remitted, kharif	2⅓ lakhs.
" " rabi	4 "
Improvement loans	¾ lakh
Advances for rabi	1 "
" " kharif	¾ "

Maximum proportion of population relieved 20·7 per cent.

10. A serious shortage of fodder may occur in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains: if there are none, it may become very great, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons juar occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognized beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. No large measures can be suggested for the improvement of the water-supply: loans should be readily given

for masonry wells and the practice of constructing field-embankments should be pressed by the offer of loans and otherwise whenever the local conditions are suitable.

12. There is at present no demand for drainage works nor so far as can be seen is the need likely to recur. The district, and particularly pargana Kalpi, is suffering slowly but steadily from the extension of ravines and denudation of the surface soils; but beyond the construction of field-embankments no palliative can be suggested.

13. To minimise losses from cattle-disease, special attention should be given to securing prompt reports of outbreaks under the rules laid down in the Land Records Manual, and sufficient veterinary staff should be maintained to localise outbreaks where they occur. Endeavours should also be made to increase the popularity of the practice of preventive inoculation.

Any action that may be authorised by Government should be taken to increase the supply of breeding bulls. There does not appear to be much risk of the grazing-grounds being curtailed to a serious extent; but the improvement of the pasturage in and near the ravines would be a very great advantage, and the district should receive special attention if any practicable methods are discovered.

14. The district is exceptionally poor in agricultural capital, and there is a wide field for the *takavi*-system. Improvement-loans should be readily given for field embankments and also if required for masonry wells. Agricultural loans may be wanted in particular in the following circumstances:—

(*a*) *Early cessation of the rains.*—There will be a large demand for sowing the rabi wherever irrigation is possible and efforts should be made to get the largest possible area: the demand for the

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following kharif is likely to be still larger, particularly in villages where little rabi has been sown: and advances may also be needed for the purchase of fodder.

(*b*) *Cattle-disease.*—It is important that cultivators should be in a position to replace working-cattle by the beginning of the next tiilage-season.

(*c*) *Agricultural improvements.*—There are considerable possibilities of improvement in the agriculture of the district, and advances should be liberally given in consultation with the agricultural department to facilitate such changes as it is in a dosition to recommend.

15. There is at present no agency other than the co-operative organisation for the introduction of agricultural improvements requiring associated action ; it is probable that the extension of that organisation will in time enable such improvements to be undertaken in a large part of the district.

The investigations in progress at the Orai agricultural station should result in the discovery of very considerable improvements, both in the tillage and in the cropping of the district : in particular the cropping of the canal-irrigated areas can probably be made distinctly more remunerative.

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DISTRICT NOTE.

BENARES.

[In examining the statistics of this district, it is important to remember that the figures of pargana Kaswar Raja was first included in those for 1910-11. Before that year this pargana formed part of the Family Domains of Benares.]

Topography.

THE district is divided into three portions, the Ganges *khadir* in the centre, Chandauli on the east, and Benares on the west.

The *khadir* is not very extensive: it includes a considerable proportion of parganas Bara and Jalhupur, and parts of Mahwari, Mawai, Ralhupur, Katehir and Dehat Amanat. This tract does not suffer from drought and the rabi area is little reduced even in a year of drought. Such kharif as is sown is liable to injury from floods.

Chandauli.—On the east of the Ganges *khadir* there is a ridge of raviny ground, from which the land slopes gradually eastward into a lowlying almost level plain of typical rice-land passing in the east into the black soil known as *karail*, which is similar to the black soil of Bundelkhand. This tract includes all of tahsil Chandauli which is not in the khadir (viz. parganas Narwan, Barhwal, Dhus and Majhwar, and portions of Mahwari Mawai, Ralhupur and Bara). Rice occupies from seven to nine-tenths of the kharif area in this tract, and much rabi is grown without irrigation in ordinary years, while there is a great deal of *jhil* irrigation.

The following portions of this tract have been noticed to suffer from floods in wet years:—

(*a*) About 35 villages on the Karamnasa in Narwan and Majhwar.

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(*b*) Eight villages in Majhwar and a few in Dhus along the Garrai river.

(*c*) A group of six villages near the Rayal tal in Barhwal.

Benares.—The tract west of the Ganges includes parganas Pandraha, Kol Asla, Athgaon, Sultanipur, Sheopur and Kaswar-Sirkar, as well as the higher portions of Dehat Amanat and Katehir. It also now includes pargana Kaswar Raja, which has recently been brought under the district administration. The soil is mostly a firm fertile loam with some lighter soil running into *bhur* on the Ganges bank, and with clay in the numerous depressions. Rice occupies from one-third to two-fifths of the kharif area, except in Kol Asla where the proportion is usually more than one-half.

Injury by flood is possible in years of excessive rainfall along the upper course of the Nand river, in the clay tract in the north and centre of Athgaon, and in some villages of Kaswar Raja on the borders of Mirzapur.

Water-supply.

There is considerable difference between the two upland tracts in regard to water-supply. Benares depends almost entirely on wells, while Chandauli has comparatively few wells, and much of the irrigation comes from *jhils* and streams.

In Benares the practice of sinking masonry wells is thoroughly established, and hostility has not been reported on the part of any landholders. Foundation-clay is practically universal and is as a rule very thick: sometimes it cannot be pierced by the ordinary country tools and requires to be bored. According to the well-survey there were still over 500 villages in which more masonry wells could advantageously be made, and in which the offer of advances was recommended. In the four northern parganas (Pandrah, Kol Asla, Katehir and Sultanipur) a considerable proportion of the villages can make temporary wells in dry years: the number of such villages is much less in the southern parganas.

Complete information has not yet been recorded regarding pargana Kaswar Raja, but it contains a very large number of masonry wells, and has been described as at least as well watered as any part of the district.

In Chandauli the number of wells is fewer, and in the *karail* soil which does not respond to irrigation there are very few. The practice of sinking wells is however established: hostility on the part of landholders has been recorded in parts of Dhus and Ralhupur, and in a few villages elsewhere. Foundation-clay is almost universal except under the *karail* soil. About 100 villages have been recorded in the well-survey as needing capital to construct more wells, and about the same number as being able to make temporary wells when required. The streams and *jhils* are as a rule fully utilised so far as the level permits: there have been occasional disputes as to the contruction of embankments on the streams, but at present they do not interfere with irrigation.

Cattle-supply.

The number of cows in the district is relatively high, but they are kept for milk rather than breeding and the quality is very poor. There are no large grazing grounds, the Ganges lowlands being cultivated as closely as the nature of the soil permits: hence the cows are not concentrated in particular localities. The supply of bulls set apart for breeding is generally sufficient.

A few cattle are imported by dealers from the Punjab, but these are only for wealthy men. The bulk of the imports come from the Dadri fair in Ballia.

The district is liable to suffer from all the common forms of cattle-disease: rinderpest is known to reach it from

Central India through Mirzapur. The practice of inoculation is now welcomed by the people.

Annals.

There are not many records of severe agricultural depression in Benares: relief has been required in the city in successive periods of scarcity, but the rural tracts have usually escaped lightly. The first regular report received was for 1894-5. In that year the lowlying tracts in Chandauli suffered considerably from floods: in 1895-6 there were no floods, but crops were generally poor owing to deficient rain. The rains of 1896 ceased in August, and the outturn of the kharif was estimated at only four annas all round, rice being almost a complete failure. For relief purposes the district was classed as a scarcity district: the city suffered much, but works opened in the rural tracts attracted few labourers. The rabi area of 1897 fell off by approximately 20 per cent. in the Chandauli tract, and by about 10 per cent. in Benares: the yield was fair, and scarcity disappeared rapidly. The rains of 1897 and 1898 were favourable, but there were floods along the Karamnasa in Chandauli. In 1899 the uneven distribution of the rains gave a poor kharif, and the following rabi suffered greatly from excessive rain, barley in particular being much injured by rust. In 1900 the kharif was again inferior and the damp cloudy weather of January 1901 brought on severe rust on wheat. In 1901 the rice was seriously injured by deficiency of rain late in the season, but the dry kharif was fair, and both rabi and kharif of 1902 were satisfactory.

The seasonal yields since 1903 are given in the following table: the figures are comparable among themselves, but the system of estimating is not yet satisfactory in this district and the estimates are almost uniformly lower than in neighbouring districts :—

Year.		Rabi.				Kharif.			
		All crops.	Barley.	Gram.	Peas.	All crops.	Rice.	Millets.	Sugarcane.
1903	...	81	88	81	81	66	69	56	75
1904	...	87	87	90	90	75	81	77	94
1905	...	41	50	37	37	81	84	81	87
1906	...	67	62	69	69	68	62	75	94
1907	...	73	75	75	53	46	27	78	80
1908	...	90	94	84	94	62	44	81	69
1909	...	87	87	87	94	78	72	84	44
1910	...	90	90	87	94	77	75	78	84
1911	...	91	94	94	81	...	...	...	...

The rabi of 1903 suffered somewhat from the absence of winter rain. The monsoon was very late and the kharif area was reduced: the early kharif was damaged by want of rain and the latter crops by excessive falls in October. A large rabi was sown for 1904 and did well though some loss was caused by rain in March. Rinderpest was prevalent during the year. The rains were again late, and were deficient in September, but good falls in October secured a large rabi area for 1905. The exceptional frosts of February did great harm to this crop, which had already suffered from damp in January. The following rains were on the whole beneficial, but some damage was caused in September by heavy floods on the Garrai and Karamnasa, which breached the Grand Chord line. Cattle-disease continued in the district, and some injury to sugarcane by insects was reported: its nature was not recorded at the time, but it is known that the cane-hopper was beginning to spread.

The rabi of 1906 was injured by rain and hail in March, and the following monsoon was too heavy at first for the

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early kharif, and then was insufficient for rice. The presence of cane-hoppers was again reported. In 1907 the rabi (especially peas) suffered from excessive rain in February and March, while the monsoon was very late and failed in September, causing very great loss to rice. The rabi area of 1908 was fairly maintained in Benares but was reduced in Chandauli: winter rains were favourable, and the crops were good. There was slight distress during this season, confined mainly to the city: aided works were open from February to June, but the number of workers was never large.

The monsoon of 1908 was again late: early rice suffered from want of rain in July, and all late crops, but especially late rice, were affected by drought at the end of the season. The cane-hopper was present throughout the district. The drought in September kept down the rabi area of 1909, but the season was favourable. The following monsoon was at first too heavy for the early kharif crops while late rice suffered for want of a final fall in October. The failure of the sugarcane crop was apparently due chiefly to the cane-hopper. Practically a normal rabi area was sown for 1910 and the winter rains were satisfactory. The monsoon was at first very inadequate, and falls were excessive in September and October. The cane-hopper was much less in evidence, but juar was injured by borers. A very large rabi was sown for 1911: the yield was good except in the case of peas which were affected by rain in March.

Progress.

The district has long been fully developed, and there has been no extension of cropping in the last two decades, nor can an extension be expected. The class of cropping shows no improvement on the whole, the bulk of the land being devoted to common food-grains. The wheat area is small, and is not increasing and the sugarcane area has distinctly fallen. The

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cultivation of hemp has extended steadily and there is now a considerable export of fibre, while potatoes have become of some importance in a few localities. Among the food crops the chief change is the extension of maize in tahsil Benares.

Construction of masonry wells has proceeded steadily the net increase in the last seven years (excluding pargana Kaswar Raja) has been over 1,800, being at the rate of 12 per cent. in Benares, and 19 per cent in Chandauli. In Benares there is now one masonry well to 19½ acres of normal cultivation, but in Chandauli the proportion is one to 50 acres.

The population of the district fell between 1891 and 1901, but there has been some recovery in the rural tracts during the last decade. In 1911 the population was 896,000 as against 922,000 in 1891.

Rural wages have risen slightly during the last five years. Cash wages below two annas are rare, and in 1911 the commonest rates lay between 2¼ and 2¾ annas. The grain rates of wages are practically unchanged, and may be valued at 1¾ to 2¼ annas.

There has been recently a marked development in advances for land-improvement: the improvements include some embankments for rice but masonry wells are the chief form. About Rs. 5,000 were advanced in the famine of 1896-7, but the aggregate in the next nine years was only Rs. 600. Partly as the result of the well-survey, advances began on a large scale in 1906-7; and excluding the famine year they have aggregated Rs. 75,000 in four years. Loans for temporary purposes were practically unknown until 1907: and even in the famine year 1896-7 they aggregated only Rs. 2,000. In 1907-8 nearly 1¼ lakh was advanced, and demand on at least this scale may be expected in an equally unfavourable season.

Agricultural co-operation has made a satisfactory start. In 1911 there were 24 rural credit societies with a working

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capital of Rs. 23,000: the movement is expanding and the formation of central banks is contemplated. Some of the societies have begun to carry out improvements in agriculture.

The district has benefited greatly by railway construction during the last twenty years. The Oudh and Rohilkhand line to Partabgarh was opened in 1898: the Bengal North-Western line to Mau in 1899: the Grand Chord line in 1900: and more recently the Bengal North-Western line to Mirzapur and Allahabad. Thus in 1911 there was one station to 44 square miles, as against 127 square miles in 1891. The system of metalled roads was practically sufficient twenty years ago and has not been extended materially.

The movement of rents has been very slow. Cash rents were first distinguished from grain rents in the figures for 1902-3: the occupancy rents then recorded gave a rate of Rs. 4·3 per acre, which has not been raised since. Competition rents at the same period gave a rate of Rs. 5·6 which has risen only to Rs. 5·9.

Outside the city, industries are of little importance. The closure of indigo factories has reduced seasonal employment for nearly 3,000 hands, and it is understood that cotton weaving has declined. In the city both silk and metal-working appear to have made some ground. Industries organised on modern lines are represented only by the brick and tile works near the city.

The district derives a very large income from external sources, if these are correctly indicated by the returns of money-orders paid. These averaged 25 lakhs annually about the year 1898, and now exceed 40 lakhs. It is understood that a large proportion of this is paid from the city offices and comparatively a small proportion in the villages.

Benares.

Dangers and possible remedies or improvements.

1. The kharif area depends on the following factors:—

(*a*) It is an advantage that the rains should begin early, but it is more important that after the ground is once thoroughly wet there should be bright weather with occasional falls for about the firsr month of the season. These conditions enable the early crops to be sown with proper tillage. Continuous rain during this period will lead to a reduced area of small millets and maize, which will be to some extent compensated by an extension of early rice.

(*b*) The second month of the season is largely devoted to transplanting rice, to facilitate which frequent heavy falls are required at short intervals, and it is an additional advantage if the intervals between the falls are cloudy. Deficiency of rain during this period will lead to a marked reduction in the area transplanted: in such conditions juar and bajra will probably be sown on a larger scale, but not so as to make good the deficiency.

(*c*) The area under sugarcane is affected to some extent by the weather in February and March, rain at this time facilitating tillage, but economic causes are of much greater importance: the area depends partly on the yields recently obtained and the price secured for the produce, and partly on the resources of the cultivators, that is on the success of the preceding harvests.

2. The yields of the early dry kharif depends on suitable weather during the first two months of the seasons: a good season for transplanting rice is ordinarily too wet for the

maize and small millets, which on the other hand will compensate to some extent for loss of the transplanted area provided the period is not very dry. The early rice will thrive when the weather is too wet for the dry crops.

The late dry crops depend mainly on moderate rain prolonged through September: their yield will be adversely affected either by excessive rain or by its premature cessation. The late rice requires fairly heavy rain lasting well into October.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

The cropping of the Benares tahsil is on the whole well balanced, and the whole kharif is not threatened by anything short of either entire failure of the rains or such heavy rain as has not been experienced: the heavier soils require most rain, and pargana Kol Asla will probably be more affected than the rest of the tahsil by deficient rainfall or a premature cessation.

Chandauli tahsil is mainly a rice-tract and is much more liable than Benares to injury either from deficient falls or from premature cessation.

3. Apart from variations in the rainfall, experience indicates the following dangers to the kharif crops :—

(*a*) Floods on the Ganges will destroy the kharif crops in the *khadir*, but the area sown with these is not large, and the loss is usually made good in the following rabi as the silt deposited is fertile.

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(*b*) The overflowing of the Karamnasa and Garrai rivers involves moving floods in parts of parganas Narwan, Manjhwar and Dhus. The floods are usually of short duration, and the injury to crops is less than would be expected, but the homesteads and cattle are threatened. The prevention of such floods is a question for engineers, but assuming them to be unavoidable it is important to see that the railways and roads in their tract are provided with sufficient waterway to pass on the floods as quickly as possible. It is understood that this has been done on the Grand Chord line since the breach that occurred in 1904, but the point should receive attention in any proposals for raising or metalling roads. The need for advances should also be considered when a flood occurs; money may be needed to replace cattle or provide seed and labour expenses if homesteads have been destroyed.

(*c*) Serious damage has been reported from certain insect-pests, viz. the cane-hopper, and boring-insects: for these see the Provincial Note, section VI.

4. The rabi area depends mainly on the rainfall of the latter half of September and the beginning of October: but in Benares tahsil the irrigation resources are so great that a serious fall below the normal has not occurred recently. Chandauli tahsil is much more liable to reduction of area when the rains cease early.

5. The rabi outturn depends relatively little on winter rain provided the seed-bed has been sufficiently moist. Falls in December and early January are beneficial provided they are moderate and of short duration: falls in February and

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March are ordinarily injurious; while continued damp and cloudy weather in January and February must be expected to bring on rust on the cereals and on linseed, and may cause very serious loss, the extent of which may not be fully realised till the crop is harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring at the usual time, the first half of January, does little harm except to the *arhar*, but a late frost such as occurred at the beginning of February 1905 must be expected to cause very serious injury.

Hailstorms are not of much importance till the cereals are beginning to ear; the danger from them increases as the season advances.

The rapeseed crop is liable to suffer severely from the aphis if damp and cloudy whether occurs while the plants are in flower.

The poppy crop may be seriously injured by damp weather late in the season.

A watch should be kept for the appearance of the potato-moth (Provincial Note, section VI), which may cause serious loss to growers.

7. The area sown with *zaid* crops is small, and it does not extend largely in unfavourable seasons.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of

deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts, but this is not known to have occurred.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the areas where rabi crops are most largely grown.

9. So far as past experience shows, the need for relief-measures will arise only in the event of premature cessation of the rains, and if these last to the middle of September special action should ordinarily be unnecessary though some postponement or suspension of revenue may be found desirable in villages depending mainly on late rice. If distress occurs, relief-works and gratuitous relief will probably be required primarily in the neighbourhood of the city, and the need is likely to be greater in the rural tracts of Chandauli than of Benares. The following action was taken in the famine of 1907-8 :—

	Rs.
Revenue suspended, kharif	22,000
,, ,, rabi	15,000
,, remitted	Nil.
Improvement loans	½ lakh.
Advances for rabi	1 ,,
,, ,, kharif	¼ ,,

Maximum percentage of population relieved 1·0 in March.

10. No serious shortage of fodder has been reported in the district, and the conditions in which a fodder-famine must be expected cannot be stated. Should it occur, importation of grass from the forests is apparently the only

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remedy that can be applied: the adjoining jungles of Mirzapur yield little or no grazing in such seasons.

11. No large measures can be suggested regarding the water-supply, but the following action is desirable:—

(*a*) Steady pressure for the construction of masonry wells in the villages where they are known to be still required and the provision of assistance by way of loans and a boring staff.

(*b*) Construction of embankments in the tracts dependent on late rice (see Provincial Note, section III).

(*c*) Construction of field-embankments in black soil of Chandauli (see Provincial Note, section II).

12. There appears to be no urgent need for drainage-works, but when the drainage of the Ganges-Gogra doab is investigated attention should be given to the areas in the Benares tahsil referred to under Topography.

13. The popularity of inoculation having been secured, it is important that the system of reporting cattle-disease prescribed in the Land Records Manual should be strictly enforced to enable early action to be taken. It is also important that the district board should employ enough veterinary assistants to cope with outbreaks of disease as they are reported.

14. The district is not well supplied with agricultural capital, and pending the organisation of alternative sources of supply the *takavi*-system should be generously worked. The chief needs for improvements are indicated in paragraph 11: agricultural loans may be required in the following circumstances:—

(*a*) ***Early cessation of the rains.***—The demand for temporary wells is important though not comparable with that of some districts; while the

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need for seed and labour is likely to be great owing to the small resources of the cultivators. In such seasons advances may be needed for the ensuing kharif as well as for the rabi particularly to replace agricultural cattle, and money may be wanted on a small scale about February for sowing sugarcane and *zaid* crops.

(*b*) After floods on the Karamnasa and Garrai [paragraph 3(*b*)].

(*c*) *On the occurrence of epidemics of cattle-disease.*—In this case it is important to see that advances are made available in time for the next tillage season.

(*d*) *Curtailment of the poppy area.*—It may be desirable to offer advances in villages where the crop has been largely grown in order to enable cutivators to substitute some other remunerative crop.

15. The prospects of agricultural improvements being effected by individuals are relatively slight, because the holdings are small and the people poor; it cannot be expected that many individuals will take up improved implements, or new methods requiring increased capital. The most suitable improvements are (*a*) better varieties of the staples now grown, especially wheat and sugarcane, when the Agricultural department has determined the best varieties suited to the locality; (*b*) new crops, such as groundnuts, that may be found suitable, requiring for their success the labour of the family rather than increased outlay. For improvements to be effected by associated action, the most probable instrument in this district appears to be the co-operative organisation, some societies of which are already moving in the matter.

DISTRICT NOTE.

MIRZAPUR.

Topography.

THE district may be divided into three tracts, the Ganges valley, the central upland, and the Kaimur range with the country south of the Son (spoken of as Sonpar). The following description takes no account of parganas Bhadohi and Kera Mangraur which now form part of the Benares State.

The Ganges valley.—This tract includes (*a*) tappas Kon and Majhwa and pargana Kariat Sikhar on the north bank of the river, and (*b*) on the south bank tappa Chhinawe, parganas Chunar and Bhuili, and the northern portions of tappa Chaurasi, pargana Bhagwat and pargana Ahraura. Most of the land north of the Ganges is *khadir*, but in Majhwa there is a considerable area of upland, where rice is the chief kharif crop. The *khadir* suffers from floods only when the Ganges is exceptionally high, and any loss is made good in the rabi. Of the country south of the Ganges, Bhuili is mainly typical rice-land; in the rest of the tract rice is grown to some extent, but the cropping is varied; the rabi is the more important crop, and is irrigated where necessary from wells. The tract is fully drained, and owing to the proximity of the hills on the south side is liable to be cut up into ravines.

The central upland.—This tract is a plateau lying between the first range of hills and the Kaimur range: it includes the whole of tappa Upraudh, taluka Saktesgarh, and parganas Barhar and Bijaigarh, with the southern portions of tappa Chaurasi and of parganas Bhagwat and Ahraura. It is drained chiefly by the Belan river which runs from east to west. The surface of the tract is not

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level. Along the nothern slopes (the watershed between the Belan and the Ganges) and over practically the whole of Upraudh and south Chaurasi the soil is a shallow stiff clay, not very productive, and frequent fallows are required. Along the Belan valley in parganas Barhar and Bijaigarah there is a broad basin of good loam growing wheat, rice and poppy.

Wild animals from the preserves of the Maharaja of Benares injure the crops in parts of Ahraura, Barhar and Bijaigarh: but this is expected by the people, and rents have been adjusted accordingly.

Sonpar and Kaimur hills.—This tract includes the Kaimur range and the country south of the Son river, for which agricultural statistics are not prepared. There is much waste land and forest, and the population is scanty, The soils vary from stiff clays to loose sand according to the elevation, but there is a tract of richer loam near Singrauli. Little wheat and no poppy is grown, and late rice is the only irrigated crop. Rabi is only grown on the homestead lands and in the Son valley: the staple rabi crop is barley. The most important kharif crops are maize, kondon, til and late rice.

Heavy floods occur on the Son, and injure the villages on the banks by deposits of infertile sand. No other injury from floods or waterlogging has been reported in this tract. Wild animals cause little loss to the crops.

Water supply.

The lowlands on the north of the Ganges do not as a rule require irrigation, nor is it easy to irrigate them as temporary wells are not readily made and foundation clay is not usually met with. The high portion of Majhwa is irrigated from masonry wells of which a large number exist, and these can be supplemented in some villages by temporary wells. On the south of the river, the rice land in Bhuili is irrigated from *jhils* and rivers, and the rest mainly from wells. Foundation-clay is by no means always met with, and over 100 villages were recorded in the well-survey as requiring wells but lacking this necessary condition for construction. On the other hand about 400 villages (mainly in Chaurasi and Chhianwe) were noted as requiring only capital to complete their equipment. There is comparatively little scope for temporary wells in years of drought: the villages that require these are noted in the well-survey.

In the central upland, temporary wells are used for valuable crops in the loam of the Belan valley, but elsewhere wells are of practically no use for irrigation. A few have been sunk to permanent supplies in the rock, but the process is very costly, and most of the existing wells are shallow and dry up rapidly. The chief sources of irrigation are reservoirs constructed by throwing embankments across the villages: in ordinary seasons the water is used to irrigate rice, and the beds of the reservoirs are then sown with rabi.

In the Sonpar tract similar reservoirs are practically the only source of irrigation. Their defect is the tendency to fail in prolonged droughts.

Cattle-supply.

The stock of cows in the Ganges valley is not large, and working cattle are imported from the Dadri fair or from the Bundelkhand breeding areas. The south of the district contains a very large stock of cows of a distinctive strain. They graze in the local jungles during and after the rains; but the grazing, or the water-supply, usually fails about December and the herds are then taken into the Native States further south. These cattle are unsuited to the Ganges plain, where they die rapidly: they are sold to the adjoining upland districts of Bengal. The only cattle brought down to the Ganges are worn-out stock or barren cows: these are sent to the Calcutta meat market.

Both rinderpest and foot-and-mouth disease are common in the district, particularly in the south. Little progress has

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been made in popularising the practice of inoculation for rinderpest, and the attitude of the people is still hostile.

Annals.

The first district report received mentions that in both 1893 and 1894 the rabi had suffered severely from excessive rain, both in the Ganges valley and in the upland. In 1895 the rains were scanty, but sufficient for the kharif: their early cessation, however, led to a great decrease in the rabi area of 1896, especially in the upland, and the absence of winter rains resulted in a poor outturn in this tract. The cessation of the rains in August of this year resulted in almost total loss of the crops in the upland and in Sonpar, and in great injury in the Ganges valley. The rabi area of 1897 was also greatly restricted and the outturn only moderate. During these seasons famine conditions prevailed throughout the district outside the Ganges valley, and relief on an extensive scale was necessary. The rains of 1897 were generally favourable, though the want of rain at the end of the season again restricted the rabi area of 1898. Much benefit was obtained from the tanks and embankments which had been constructed as relief works in the upland and Sonpar tracts, but it was reported that more works of the kind were still necessary. The next rains were also favourable; but in 1899 the want of rain late in the season again reduced the rabi area, and the yield of both harvests was poor. There was actual distress but the Sonpar tract was reported to require watching. The rabi area of 1902 was once more contracted for want of late rain: the yield, however, was good. During the hot weather the supply of water in the drinking wells in the upland was inadequate.

The seasonal yields since 1903 are given in the following table. In the absence of complete statistics of the area sown, it is not possible to calculate an average figure for all the crops of a harvest.

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Mirzapur.

Year.			Rabi.				Kharif.	
			Wheat.	Barley.	Gram.	Linseed.	Rice.	Small millets.
1903	...	...	81	75	75	75	84	72
1904	...	...	94	94	81	87	69	50
1905	...	...	69	75	75	62	78	69
1906	...	...	87	87	81	75	87	87
1907	...	...	87	94	87	94	16	87
1908	...	...	81	75	56	62	75	87
1909	...	...	75	87	87	75	94	100
1910	...	...	87	87	94	94	100	100
1911	...	...	94	100	94	106	...	...

The rains of 1902 were prolonged, and the rabi area of 1903 was in consequence larger than it had been for some years: the winter rains were however deficient. The monsoon was late, but lasted well into October and gave a large rabi area for 1904, while causing some damage to the kharif crops. The following rains were unevenly distributed: the early kharif suffered from excessive rain and rice from a long break in September. Good falls in October enabled the rabi area of 1905 to be maintained. The crops suffered from excessive damp, which produced rust on the cereals and insects on the oilseeds; the exceptional frost of February did not cause very serious injury except in the case of *arhar* and linseed.

The following monsoon began somewhat late and ceased prematurely: this led to a reduction in the rabi area of 1906, which however yielded fairly well. In 1906 the rains were favourable until the end of the season, but there was not sufficient moisture for a full rabi for 1907. The winter rains were favourable. The monsoon of 1907 began well, and the early kharif crops were fair: but September was dry and all the late crops, especially rice, were very nearly failures. Less than half the ordinary area was sown for the following rabi, and the crops suffered considerably before rain came

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in February. During these seasons there was little distress in the Ganges tract but the uplands and Sonpar suffered acutely from famine, and extensive relief measures were required from December to the following August. The rains of 1908 were late, and were somewhat deficient in September, specially in pargana Bijaigarh. The severe outbreak of malaria combined with the dryness of the ground to reduce rabi sowings and the winter rains were scanty and unequally distributed, Bijaigarh again faring worst. Relief measures had to be resumed in this pargana in March 1909, and maintained until July, when the monsoon was fully established.

Recent seasons have been more favourable: the rains of 1909 gave a good kharif yield, and a fair rabi area for 1910: winter rains were good The monsoon of 1910 was again excellent and its prolongation into October ensured further progress towards recovery in the rabi area: winter rains were good and the rabi of 1911 was an excellent crop. In this year extension of cultivation was proceeding in the Singrauli area of Sonpar, where jungle was being cleared.

Progress.

Cultivation in the Ganges tract was fully developed at an early period, and there has been no appreciable change during the last two decades. In the uplands cultivation fluctuates so greatly with the seasons that it is difficult at any time to say whether there has been a permanent change, but the area returned in 1911 was substantially below that of the years about 1892. It is understood that the case of Sonpar is similar, though as has been noticed above reclamation has now begun.

It is understood that the class of crops in Sonpar has not changed materially: in the rest of the district the proportion of remunerative crops fell seriously after the famine of 1897, but has now almost recovered its former level. The sugarcane area has fallen off somewhat, and wheat is practically unchanged: cotton appears to be increasing in the upland though the area is not yet great, and hemp has extended in the Ganges tract.

There has been no marked improvement in the irrigation facilities of the Ganges tract: the number of masonry wells shows a slight increase in the last few years, but construction has proceeded much more slowly than in Benares.

In the uplands and Sonpar there has been a considerable increase in the number of embankments, many of which were constructed as relief works in 1897 and 1908; the effect of these works may be gathered from the statistics of irrigation from "other sources:" in the four parganas which lie entirely within the tract close on 48,000 acres were so irrigated in 1907-8 as against less than 5,000 acres in 1896-97. The area is however still small compared to the total cultivation. For Sonpar no figures are available, but it is understood that there too much has been done, but that most of the land is still unprotected.

A comprehensive scheme of irrigation canals has been worked out to serve a large portion of the uplands and also the rice country in the east of the Ganges tract: most of the projects have been sanctioned, and work is in progress or about to begin.

The population of the district declined between 1891 and 1901: a slight further fall was recorded in 1911 but the decrease occurred in the city. The figures available do not show separately the population of the three tracts, but there has been a distinct increase in Roberstganj and Dudhi, while the rural population in Mirzapur and Chunar has been practically stationary.

The cash rate of rural wages has varied little in the last five years: the usual rate in 1911 was two annas, but 2¼ was also paid. The higher grain rates recorded in 1906 have disappeared and have presumably been replaced by cash wages.

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Advances for land improvement were almost unknown until 1906, but relatively large sums have been distributed in the last five years, giving an average of Rs. 16,000 for the four years excluding 1907-8. Loans for temporary purposes were also little known, but in 1907-8 they aggregated close on eight lakhs, with half a lakh in the following year. There has so far been no development of agricultural co-operation, but a beginning has just been made on the Kantit estate where a trained organiser is at work.

The Ganges tract is well supplied with means of communication, and these have been materially increased during the last twenty years, first by the opening of the Oudh and Rohilkhand main line through the north of the district, and more recently by the Bengal North-Western line from Benares to Allahabad which runs nearer the Ganges and has a branch to Mirzapur ghat.

In the uplands and the Sonpar tract, means of communication are still very deficient though there has been improvement in the unmetalled roads. The metalling of the road to Robertsganj, which is now in progress, will be a substantial advance. Proposals have occasionally been made for extension of the East Indian Railway into the uplands, but these have been abandoned or held in abeyance.

The movement in rent-rates has been trifling in recent years. Rents of recorded occupancy tenants have given a rate of approximately Rs. 3·0 per acre since 1902, and other rents have given rates of from Rs. 2·3 to 2·5 in the same period.

The rural industries of the district are of considerable importance, and are not as a whole declining. In the jungle tracts the chief industries are collection of tasar cocoons and preparation of catechu. Stone-quarrying on the outer scarp of the uplands is increasing in importance and affords a large amount of employment; while European firms have in recent years brought about a very considerable development in

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carpet-weaving. In the city the metal and shellac industries are believed to have expanded, and a small cotton-spinning mill has been established. Iron of good quality is still produced in the south of the district, but the development of such mineral wealth as exists is impossible in the present state of communications.

The district has a substantial income from external sources: the sums distributed in money-orders have aggregated about 14 lakhs in each of the last two years having risen steadily to this point from the average of about nine lakhs that ruled about 1898.

Dangers and possible remedies or improvements.

1. The Ganges valley requires for a full kharif area an early start of the rains followed by about a month of moderate falls with bright intervals to facilitate tillage and sowing. The second month should be marked by more frequent falls and less bright weather to enable rice to be transplanted. The area of dry crops will be reduced by excessive rain in the first month, and that of late rice by drought in the second: but deficiencies will be made good to some extent by sowings of bajra if the second month is dry.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage : but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

The conditions in the uplands and in Sonpar have not been recorded in detail, but it is understood that light falls of rain at short intervals give the largest area.

2. The yield of the early kharif crops, the small millets and maize, will be injuriously affected by continuous or excessive rain in the middle of the season, and they must

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be expected to suffer to some extent when the season favours transplanting rice. Of the later crops rice is much the most important, and it requires the prolongation of the season with moderate falls into October. In so far as this crop is not to be protected by canal irrigation, almost entire loss must be expected if September and October are dry. *Bajra* requires much less rain than the late rice.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rain: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

3. Apart from variations in the rainfall, no serious dangers to the kharif have been recorded. Floods in the Ganges cause loss only in exceptional years, and the gain to the rabi more than counterbalances the immediate loss. The small area sown with sugarcane has been injured by the cane-hopper (vide Provincial Note, section VI), and the same, or similar, insects have on one occasion injured rice.

4. The rabi area depends on the prolongation of the rains through September into October. Drought at this period results in a substantial reduction in the Ganges valley, but its effects are much more marked in the uplands and Sonpar, where sowings depend entirely on the rainfall.

5. The rabi outturn in the Ganges valley depends relatively little on winter rain provided the seed-bed has been sufficiently moist. Falls are however beneficial in this tract during December and early January provided that they are moderate and of short duration: falls in late February and March are ordinarily injurious, while continued damp and cloudy weather in January and February must be expected to bring on rust on the cereals and on linseed, and

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may cause very serious loss, the extent of which may not be fully realised till the crop is harvested.

In the uplands and Sonpar, where there is very little irrigation, winter rains are essential to the success of the crop. The best time for them is December-January, but if these months have been dry benefit will result from rain in February. Continued damp and cloudy weather may produce rust in these tracts as in the Ganges valley, but the net result of winter rains is beneficial.

6. There are very few reports of serious injury from frost. The great frost at the beginning of February 1905 was felt, but injury was severe only in the case of *arhar* and linseed. The conditions under which frost may be a serious calamity are not definitely known: but a severe frost in the latter half of January might cause substantial loss in the Ganges valley, and to a less extent in the uplands.

The extent of the injury from hailstorms depends on the stage which the crops have reached; as a rule the danger begins when the cereals are earing, and it increases with the lateness of the season.

Rapeseed may be severely injured by the aphis; the spread of this pest results from damp weather at the time the crop is in flower.

7. *Zaid* crops are sown on a very small area; no dangers to them have been reported.

8. Distress must under present conditions be expected to result from a premature cessation of the rains; it should not ordinarily occur if rain continues past the middle of September: but the position will be serious when rain has stopped by 15th, and famine conditions seem to be inevitable if it has stopped by the first of the month. It is not anticipated that the Ganges valley will require direct relief, but in the uplands it is likely to be needed early in December.

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Mirzapur.

The following relief measures were carried out in 1907-8:—

Revenue suspended, kharif	1¾ lakhs.
" " rabi	Rs. 41,000
Revenue remitted	Nil.
Improvement loans	¼ lakh
Advance for rabi	2 lakhs
" " kharif	5½ "

The maximum proportion of the population on relief was shown as 19 per cent. in the resolution on the famine, but it was nearly 33 per cent for the upland tracts in which direct relief was given. The maximum was reached in February.

9. As regards improvement of the water-supply of the Ganges valley, the construction of the Garrai canals will prove of very great benefit to the rice-tract in Bhuili. Apart from this scheme the only action required is to continue to give facilities for the construction of masonry wells in the villages where they are known to be possible; and for embankments in such rice-areas as are not to be protected by the canals. There is still room for very many more wells.

For the uplands the Ghagar canal has been sanctioned and the Ghori Nadi and Sukhra Nadi schemes are well advanced. The early construction of the sanctioned works is a matter of great importance for this tract: the only other measure that can be suggested for it, and the only measure for Sonpar, is the construction of still more small reservoirs wherever the conditions are suitable.

It is hoped that the schemes now sanctioned will protect the Belan valley adequately against a premature cessation of the rains: they do not affect the high ground on the north, or the slope of the Kaimur range.

It must be recognised that the canals and reservoirs are all storage schemes, and that they will be ineffective if no rain falls throughout the season in their catchment areas: past experience however indicates that the realisation of this condition is most improbable; the configuration of the country is such that rain can be counted on as almost certain at some period of the season, and this will be stored up for use later in the year.

10. A fodder famine appears to be most unlikly in the Ganges valley. Fodder may become very scarce in the upland tracts during the hot weather following on a drought, but the state of communications makes import from a distance practically impossible.

11. No drainage works appear to be required in the district.

12. The south of the district is recognised as one of the sources from which rinderpest reaches other parts of the provinces, and it is most desirable that efforts should be made to popularise the practice of preventive inoculation, and that when this has been achieved an adequate local organisation should be provided to deal with outbreaks at or near their source.

13. The development of the Sonpar tract depends primarily on the provision of adequate means of comunication. The bulk of the land is inferior, and no great agricultural development can be expected, but no development of any kind is possible at present: improved communications would probably result in the exploitation of the coal, iron, and other minerals that are known to exist, and in the extraction of jungle produce; and in any case they are required as a protective measure. In the last famine the price of course food-grains in this tract rose to five, and even four seers per rupee. The best route appears to be a light railway taking off from Garhwa Road or Untari Road on the Daltonganj line and running through Dudhi and on to Kota on the border of the Rewah State.

14. The district is not well supplied with agricultural capital, and pending the development of other sources of supply

the *takavi*-system should be generously worked, as has been the case in recent years. Improvement loans may be required for :—

(*a*) masonry wells in the Ganges valley :

(*b*) reservoirs (including repairs) in the upland and Sonpar tracts :

(*c*) embankments in the late-rice areas not to be commanded by canals (vide Provincial note, section III).

Agricultural loans may be wanted—

(*a*) *In the event of premature cessation of the rains.* Large sums will be required in the Ganges valley to sow rabi ; advances at this time are of less value in the uplands, because little rabi will be sown unless rain should fall at the end of October or in November, but their issue will enable the people to profit by such a chance, and will in any case keep them off the relief works. In this case the loans should be remitted if rain does not fall in time for sowings. Very large sums will be wanted in the upland tracts to sow the next kharif.

(*b*) *On the occurrence of losses by cattle disease.* In this case it is important that advances should be made available in time to provide cattle for the next tillage season.

15. The cultivators in the Ganges valley are not as individuals in a position to take up agricultural improvements requiring capital outlay. The most suitable improvements are the supply of better varieties of crops now sown, and of new crops requiring labour rather than capital, when these have been determined by the agricultural department. The prospects of co-operative organisation are uncertain, but no other form of associated action for effecting improvements can be suggested at present.

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Mirzapur.

The uplands and Sonpar tracts have not yet been examined by an expert agriculturist, and until this has been done no suggestions for improvements can be put forward. In Sonpar the management of the government estate is in a position to facilitate the introduction of any improvements that appear to be desirable.

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DISTRICT NOTE.

JAUNPUR.

Topography.

THE district may be divided into four principal tracts: the exact limits of these cannot be stated as the district being permanently settled assessment circles have never been framed.

The first of these tracts lies to the north-east of the Gumti. The watershed here is very near the river, and the land beyond it drops rapidly into an extensive plain of clay, with very numerous *jhils* and wide stretches of *usar* land. Rice is much the most important crop, and the bulk of it is transplanted. This north-eastern tract consists mainly of pargana Ungli (excluding only the land close to the Gumti), but it also includes the north-east of tahsil Jaunpur and a small area on the north of Kirakat. The drainage is imperfect: the surface water passes eastwards into Azamgarh by more or less defined channels, but the *jhils* extend widely in wet seasons.

The second tract—the central loam—includes all the land along the Gumti and the Sai, and the doab of these rivers: it thus covers nearly all of Kirakat and extends into the north of Machhlishahr and Mariahu. The prevailing soil is a rich loam; poorer and lighter land broken in places by ravines is found close to the river banks, while there is some heavy clay in the west where the doab is comparatively wide. The tract as a whole is adequately drained. The lowlands along the rivers are almost inconsiderable in extent: heavy floods

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occur on both rivers and may cause considerable loss of property, but their agricultural importance is slight. Some villages in Zafarabad and Haveli are infested with the *baisurai* weed (*Pluchea lanceolata*), the local name of which is *rasni*.

South of the Sai lies another large clay tract It covers the greater part of tahsil Machhlishahr, extending at this point to the south of the district: in Mariahu it becomes narrower its southern limit being marked by the Bisuhi stream, which has here formed a well-defined channel. In this tract *jhils* and extensive *usar* plains are common, and late rice is the most important crop. The drainage is imperfect, especially in the south-west: some minor drainage works have been carried out near the town of Badshahpur, but a complete drainage system does not exist.

The fourth tract is the south of Mariahu, between the Bisuhi and the Barna, the latter forming the southern boundary of the district. The prevailing soil is fertile loam: there are few *jhils* and the drainage is adequate. The *rasni* weed is found in some villages in this tract.

Water-supply.

In the clay tracts the *jhils* are extensively used for irrigation, but even there wells are much the most important source, and in the loam tracts they are practically the only source. Conditions are exceptionally favourable for sinking masonry wells as foundation-clay is almost universal, being unknown only in a few places along the rivers. It is usually of considerable thickness, and boring tools may be required to pierce it. Hostility to masonry wells appears to be entirely absent, but there are a few cases where portions of a village that require water are left dry on the ground that wells there would be inauspicious. Well-sinking has been actively carried on, and Jaunpur is as fully provided as any district in

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the provinces ; but about 800 villages were recorded in the survey as requiring still more wells. Temporary wells are possible in most places, and there is ample scope for advances for their construction in a dry September : the villages where they are likely to be most wanted are recorded in the survey.

Cattle-supply.

The stock of cows is proportionately greater than in south Oudh : but there are no grazing grounds, and the stock is therefore not concentrated. The cows are of poor quality, and as they are kept primarily for milk the young stock are necessarily inferior. The supply of bulls is usually sufficient.

Superior working-cattle are imported in small numbers by dealers coming from the Batesar and Makanpur fairs : the bulk of the imports come from the Dadri fair or the breeding-tracts in Bahraich and Bundelkhand.

The district is liable to all the common forms of cattle disease. There appears to be little active hostility to the practice of inoculation, but it is not yet appreciated by the people.

Annals.

There are no records of serious agricultural depression in Jaunpur previous to the regular deterioration reports, which were first submitted for the year 1894-95.

In 1894 there were heavy floods on the rivers which injured the standing crops but did no permanent harm. The excessive rain in February reduced the rabi outturn of 1895 very considerably. In the following seasons both rice and rabi suffered from insufficient rain.

In 1896 the rains ceased in August : maize and the early millets gave a moderate yield, but early rice suffered greatly, late rice failed entirely, and juar and *bajra* gave very little produce. The district was for relief purposes classed as a famine district: distress appeared first in Ungli, and throughout was most severe in the north and in the south-west of the district. A fairly large rabi area was sown for 1897, and though the produce was not particularly good, distress disappeared when the early kharif of 1897 was harvested. That year and the following were favourable. In 1899 there was some injury to the rice from deficient rain at the end of the season: while some villages on the borders of Allahabad and Partabgarh suffered from the overflow of the *jhils* earlier in the season. In 1901 both wheat and barley suffered severely from rust owing to the dampness of the cold weather. The early cessation of the following rains resulted in severe injury to the late rice, and a low rabi area. The rains of 1902 were generally favourable, but sugarcane suffered first from white ants and then from some insect which was not identified.

The seasonal yields since 1903 are given in the following table :—

Years.	Rabi.				Kharif.			
	All crops.	Wheat.	Barley.	Peas.	All crops.	Rice.	Maize.	Sugar cane.
1903 ...	100	100	100	88	80	84	69	87
1904 ...	87	87	87	87	81	87	81	81
1905 ...	63	75	69	44	86	81	94	81
1906 ...	88	87	87	87	74	60	87	87
1907 ...	87	87	87	81	58	27	75	60
1908 ...	112	113	119	113	87	69	100	75
1909 ...	93	94	94	94	90	92	87	65
1910 ...	101	165	103	96	94	100	94	94
1911 ...	95	94	94	94	...	...	...	...

An excellent rabi was secured in 1903 when there was practically no winter rain. The monsoon was late, and the

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kharif area fell owing to the impossibility of transplanting rice. Rain was heavy in the latter portion of the season and there were floods on the rivers ; the season was particularly unfavourable to maize, while injury to sugarcane was reported in this year from the cane-hopper. A very large rabi area was sown for 1904, and it yielded well. The rains of this year were favourable at first but somewhat deficient in August. Falls at the end of the season secured another large rabi area for 1905. The exceptional frost in February of this year caused very great injury to *arhar* and peas, and also injured cereals. The following monsoon was favourable to the early kharif but the later falls were inadequate. The cane-hopper again injured sugarcane. The rabi area of 1906 was reduced owing to want of moisture ; the crops suffered somewhat from late rain and in places from hail. The rains were good until the middle of August but afterwards were quite insufficient for rice ; while the cane-hopper had spread over a large area.

The rabi of 1907 was fairly satisfactory but the monsoon, after starting very late, failed in September. The late rice was entirely lost over large areas : and sugarcane suffered both from drought and from the attacks of cane-hoppers. No rain came to assist sowings and the rabi area of 1908 was below normal, but it was remarkably large for the season, and with favourable rains it gave an excellent yield. During these seasons distress was experienced in the clay tracts, and relief measures were required from December until August. Distress reached its maximum in February, when over four per cent. of the population were in receipt of some form of relief.

The rains of 1908 were ill-distributed ; the rice tracts received least, and the crop was poor, failing completely in considerable tracts of pargana Ungli. The cane-hopper continued to spread. The rabi area of 1909 was somewhat

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short, but the yield was good. There was some anxiety regarding pargana Ungli in this season, and though the existence of scarcity was not declared arrangements were made to provide employment by aided works. The following rains were copious, rather heavy for maize ; the damage caused by hoppers to sugarcane was again extensive. A large rabi was sown for 1910 and the season was very favourable with rain just at the right time in January. The monsoon was weak at first but improved greatly, and the rice crop was at last a success. The heavy rain gave an increased rabi area for 1911 and this too was a success, though rain in March caused some deterioration. Rinderpest was widespread during this year : and there were many complaints that the sugarcane stock was worn out, and requests for the import of seed-canes of other varieties. The cane-hopper was still present, but apparently over a smaller area than in previous years.

Progress.

There has been a very slight extension of cultivation during the last two decades, made up mostly of land on the edge of *jhils*, of small areas of *dhak* jungle cleared, and of patches of *usar* reclaimed for rice. There is no room for further material expansion. The proportion of remunerative crops is low and tending to fall further. Sugarcane has fallen considerably, and indigo (at one time important) has practically disappeared. On the other hand the wheat area is well maintained : hemp has extended substantially, and linseed is more grown in the south-west since the opening of the railway. Potatoes have also extended, and the crop is of much importance near the city. The area under poppy has not been large in recent years. Among food grains the most noticeable change is the extension of maize which has proceeded steadily until the area is close on 100,000 acres.

Construction of masonry wells has been rapid, especially in the last few years. Between 1905 and 1911 the number

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of such wells increased by nearly 7,000 or by 27 per cent: there is thus now one well to 20 acres of normal cultivation, as against 26 acres in the earlier year.

The population of the district has fallen steadily in the last two decades; in 1911 it stood at 1,156,000 as against 1,265,000 in 1891.

Agricultural wages have risen slightly in the last five years, and in 1911 the cash rate did not fall below two annas, though grain rates were in some cases lower.

Until recently the system of agricultural advances has been little appreciated in this district. A substantial sum was lent for land improvement during 1896-97 but practically nothing from that time to 1906. There has however been a sudden change: over 1½ lakhs were advanced during 1907-8 and since then further advances have aggregated more than half a lakh. Loans for temporary purposes are not taken in ordinary years, but are much needed in unfavourable seasons.

Agricultural co-operation has made a satisfactory start in 1911; there were 98 rural credit societies with over 2,300 members and a working capital of about Rs. 90,000; these are financed by the Jaunpur district bank. Some of the societies are beginning to interest themselves in agricultural improvement.

The district has benefited greatly by railway extensions during the last twenty years: the lines opened comprise the Oudh and Rohilkhand main line and the Allahabad-Jaunpur branch, as well as the Bengal and North-Western line from Shahganj to Azamgarh and from Jaunpur to Aunrihar. In 1911 there was one station to 82 square miles, as against 221 square miles in 1891. The mileage of metalled roads is large, and has been increased by the road connecting Kirakat with head quarters, while the town of

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Machhlishahr is now being provided with a road to the railway at Janghai. The chief need of the district is for more bridges on unmetalled roads.

The movement of rents has been very slight. Figures for comparison are available from 1902, and during this period the occupancy rent-rate has remained constant at Rs. 4·9 per acre, and the rate of other tenants has risen only from Rs. 5·2 to Rs. 5·4.

Industrial employment has declined substantially. The indigo factories, which used to give seasonal employment to some thousands of hands, have been almost entirely closed: sugar-refining has decreased, as a larger proportion of the reduced product is exported in the raw state, and cotton-weaving and perfume-making are yielding to competition. There has been no attempt to establish manufacture on a large scale.

The district has important sources of external income, chiefly it is understood remittances from residents in service elsewhere. About 1898 the sums distributed in money-orders averaged 16 lakhs annually, and this figure has risen to about 24 lakhs or approximately double the land-revenue of the district.

Dangers and possible remedies or improvements.

1. The kharif area depends on the following factors :—

   (*a*) It is an advantage that the rains should begin early, but it is more important that after the ground is once thoroughly wet there should be bright weather with occasional falls for about the first month of the season, enabling the early crops to be sown with proper tillage. Continuous rain during this period will lead to a reduced area of small millets and maize, which will be compensated only to a limited extent by an extension of early rice.

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(*b*) The weather in the second month of the season determines the area under late rice, which is the chief crop of the two clay tracts. Frequent heavy falls are required at this period; cloudy weather is an advantage and any prolonged intervals between the falls is injurious. If the rainfall is insufficient for transplanting, a proportion of the clay soils will remain fallow; *juar* and *bajra* will in that case be sown on a somewhat extended scale but in the clay tracts this will be possible only on a relatively small area.

(*c*) The area under sugarcane is affected to some extent by the weather in February and March, rain at this time facilitating tillage, but economic causes are of much greater importance; the area depends partly on the yields recently obtained and the price secured for the produce, and partly on the resources of the cultivators, that is on the success of the preceding harvests.

2. The yield of the early dry kharif (maize and small millets) depends on suitable weather during the first two months of the season: a good season for transplanting rice is ordinarily too wet for these crops. The early rice will thrive when the weather is too wet for the dry crops, but will probably give a somewhat deficient yield when these are most successful.

The late dry crops depend mainly on moderate rain prolonged through September: their yield will be reduced either by excessive rain or by its premature cessation. The late rice requires fairly heavy rain lasting into October, and if both September and October are dry it must be expected to fail almost completely.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather : the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains : a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

In the two loam tracts the cropping is on the whole well balanced. The most favourable season is one of moderate falls prolonged to the end of September ; heavy rain in the early half of the season may be very injurious to maize the staple crop, while the late crops will suffer from either a very dry or a very wet September. The rice-tracts on the other hand require much more rain, first in the transplanting season and then in September and October : the northern tract is even more dependent on late rice than the southern, and requires even more careful watching if September is dry.

3. Apart from variations in the rainfall, experience does not indicate many dangers to the kharif crop. Floods must be expected on the Gumti and the Sai : they do not affect large areas of cultivation, but agricultural loans may be required on their occurrence, especially if homesteads of cattle have been destroyed. The only serious injury hitherto reported from insect-pests is that caused by the cane-hopper (see Provincial Note, section VI).

4. The rabi area depends mainly on the rainfall of the latter half of September and the beginning of October : in the loam tracts the irrigation resources are so great that a serious fall below the normal has not recently been recorded, but the clay tracts are much less fortunate, and only a small rabi can be sown in them when the late rice has been poor.

5. The rabi outturn depends to a relatively small extent on winter rain, provided the seed-bed has been sufficiently moist. Falls in December and early January are however beneficial provided they are moderate and of short duration; falls in February and March are ordinarily injurious; while continued damp and cloudy weather in January and February must be expected to bring on rust on the serials and on linseed, and may cause very serious loss, the extent of which may not be fully realised till the crop is harvested.

When the ground has been dry at sowing time and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring at the usual time, the first half of January, does little harm except to the *arhar*, but a late frost such as occurred at the beginning of February 1905 must be expected to cause subtantial injury to the cereals, and also to peas: the effect on particular crops varies according to the stage of development they have reached when the frost occurs.

The extent of the injury from hailstorms also depends largely on the stage of development, but as a rule it increases as the season advances.

The only serious injury reported from insect-pests is that caused by the aphis to rapeseed; it spreads to a dangerous extent if damp weather occurs while the plants are in flower.

The potato crops are liable to injury from the potato moth (see Provincial Note, section VI).

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7. The area sown with *zaid* crops is small and no causes of injury to them have been reported.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts ; this has not been reported to have occurred but about 1909 there was some anxiety on the point.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the loam tracts.

9. So far as past experience shows the need for relief measures will arise only in the event of premature cessation of the rains ; if these last into September the loam tracts should not require relief, and direct relief should not be wanted in the late rice tracts, though postponement or suspension of revenue may be found desirable if no further rain falls. With a dry September the need for direct relief measures will probably arise.

The following action was taken in the famine of 1907-8 :—

Revenue suspended kharif	Rs. 44,000
" " rabi	Nil.
Revenue remitted	Nil.
Improvement loans	1½ lakh.
Advances for rabi	1½ "
" " kharif	Nil.

Maximum percentage of population relieved 4·0 in February.

10. The conditions under which a serious general shortage of fodder may occur cannot be stated definitely as experience is wanting ; but the loss of the late dry crops is not

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apparently sufficient to cause a scarcity, and it would seem that both August and September must be dry to produce a serious position.

11. The following measures for improving the water-supply are indicated :—

(*a*) Steady pressure for the construction of masonry wells in the villages where they are known to be still required ; and provision of a boring staff for the assistance of the public.

(*b*) Construction of embankments in the tracts dependent on late rice (see Provincial Note, section III).

12. There appears to be no urgent need for the construction of drainage-works, but the rice tracts, and especially the extreme south-west of the district, should be watched in wet seasons, and should be considered when the drainage of the Ganges-Gogra doab is investigated.

13. For protection against losses from cattle-disease, it is most desirable that the leaders of the people should be induced to popularise the system of preventive inoculation, which has not yet been fully accepted by the district. Steady attention should also be given to the enforcement of prompt reporting prescribed in the Land Records Manual, and sufficient veterinary staff should be maintained to localise outbreaks where they occur.

14. The district is not well supplied with agricultural capital. The prospect of increasing the supply on co-operative lines is very hopeful, but in the meantime the *takavi*-system should be generously worked. Improvement loans are required chiefly for (1) masonry wells, and (2) embankments in the rice tracts ; while agricultural loans can be given with advantage in the following circumstances :—

(*a*) *Early cessation of the rains.*—The demand for temporary wells, seed and incidental expenses is likely to be large in early October : there may be

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a further demand in February on a smaller scale for sowing sugarcane and *zaid* crops, and again in June for the kharif, particularly if losses of agricultural cattle have been serious.

(*b*) *Floods on the Gumti and Sai.*—(Vide paragraph 3).

(*c*) *Losses from cattle disease.*—In this case it is important to see that the advances are made available in time for the next tillage season.

15. The resources of the majority of cultivators are so small that there is comparatively little hope of securing improvement in agriculture through the unorganised action of individuals. The most suitable improvements at the present time are (*a*) better varieties of the staples now grown, especially sugarcane in the case of which the people are dissatisfied with the varieties which they now cultivate ; (*b*) new crops that may be found suitable, requiring for their success the labour of the family rather than increased outlay in cash.

For improvements to be effected by associated action the most probable instrument is the co-operative organization.

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DISTRICT NOTE.

GHAZIPUR.

Topography.

THE district may be divided into three principal tracts, the northern upland, the Ganges tract, and the southern tract.

The northern upland includes parganas Bahriabad, Shadiabad, Pachotar, Zahurabad and Dehma, with parts of Khanpur Saiyidpur, Ghazipur and Muhammadabad. Along the edge of the Ganges alluvium, and also along the streams that flow into it, there is usually first some poor light soil, then good fertile loam, occasionally tailing off into interior sandy soil. Away from the drainage lines, the soil rapidly gets stiffer, so that the prevalence of *usar* and rice-land is characteristic of the tract as a whole. The two following areas in particular are almost entirely dependent on rice: (*a*) the portions of Saiyidpur and Bahriabad lying between the Gangi and the Udwansi streams; (*b*), the northern half of Pachotar with the adjoining part of Zahurabad. The drainage is locally defective in the places where *jhils* are most numerous, but the people are not anxious for improvement, fearing the loss of water in dry years.

The Ganges tract includes most of Karanda and Muhammadabad, and parts of Khanpur, Saiyidpur and Ghazipur on the north of the river: and on the south about half of Zamaniah and a little of Mahaich. The soil is mainly fertile loam, though all classes of land are found, and there are two large areas of the black soil known as *karail*. Much of the kharif is subject to injury from the Ganges floods, but if these retire in time and the winter is dry the loss is more than made up by the yield of rabi. The rabi depends for its success on the annual deposit of silt which is usually very heavy. In years when there are no floods the rabi area tends to fall.

The southern tract includes half of Zamaniah and nearly all of Mahaich. The tract is not homogeneous. There is a stretch of very fertile black soil along the Karamnasa, and the rest of Zamaniah is mostly productive and well irrigated. The bulk of Mahaich on the other hand is poor soil producing mainly rice. The Karamnasa flows between deep banks, but occasionally these are topped by the floods which then cause considerable injury. The rabi area in this tract falls markedly after a dry September.

Water-supply.

In the northern tract the *jhils* are largely used for irrigation, but cheap masonry wells are by far the most important source: the alluvial land does not require irrigation, and the sandy subsoil makes wells almost impossible; in the southern tract the black soil and the clay in Mahaich do not respond to irrigation, but wells are freely used in the loam.

The practice of sinking temporary wells has not developed largely in this district, masonry wells being preferred: but there is a substantial number of villages (enumerated in the well-survey) where the practice exists and where advances will be required in seasons of drought. The masonry well is much more popular, and the number available is increasing in all parts of the district. Foundation-clay is met with almost everywhere, and is sometimes so thick as to require boring in order to reach the spring; it is missing in about 130 villages, lying chiefly in Shadiabad and Muhammadabad. No hostility to wells has been reported in any part of the district: the local authorities who conducted the well-survey considered that a very large increase in the number of wells is required, and that their extension is purely a matter of capital.

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Cattle-supply.

The stock of cows in the villages is relatively large, but in the absence of any grazing tract it is not concentrated. The cows are kept mainly for milk: they are of poor quality and poorly fed, and the local working stock is naturally defective.

The principal source of import is the Dadri fair in Ballia: cattle are also brought by dealers from the Makanpur fair and from some of the breeding areas in the north of the province.

The district is liable to all the common forms of cattle-disease, but there has been little rinderpest in recent seasons. The practice of inoculation has secured popularity where it has been carried out.

Annals.

There are few records of agricultural depression in Ghazipur. Apprehension was felt during each of the droughts of the nineteenth century, but in every case the district did better than was expected. The first regular report was received in 1895; it did not indicate any serious injury from the series of wet years which closed in 1894. At the end of 1895 late rice suffered seriously from drought and the rabi area of 1896 was somewhat contracted. The monsoon of this year ceased about the end of August and late rice did very badly, while the rabi area of 1897 was further contracted. Test works opened in the winter failed to attract labourers, and distress was at no time serious, though works were required in the southern tract during part of the hot weather.

Two good years followed, but in 1900 the rabi was seriously injured by hail over a wide area and the rice suffered from drought at the end of the season. The rabi of 1901 was sown on a reduced area, and wheat suffered injury from rust, while the succeeding rice crop was again injured by drought. The year 1902 was prosperous; but sugarcane was seriously injured by the cane-hopper.

Ghazipur.

The seasonal yields since 1903 are given in the following table :—

Year.	Rabi.					Kharif.			
	All crops.	Barley.	Gram.	Peas.	Poppy.	All crops.	Rice.	Small millets.	Sugarcane.
1903 ...	105	20	88	88	125	75	75	69	81
1904 ...	83	81	84	84	75	60	65	38	94
1905 ...	53	69	44	31	75	77	77	83	94
1906 ...	76	75	81	75	75	84	69	94	94
1907 ...	75	81	75	62	62	47	20	75	60
1908 ...	78	81	81	75	75	73	44	87	75
1909 ...	94	95	93	95	75	79	56	87	81
1910 ...	95	98	92	92	80	87	87	81	94
1911 ...	95	95	97	97	50	...	...	...	...

The rains of 1903 were late and at first scanty, so that the kharif area was reduced : later they were heavy. Some injury was caused by floods on the Ganges, and the small millets yielded poorly. A large rabi was sown for 1904, in which season there were practically no winter rains. The following rains were at first so heavy as to cause serious injury to the early kharif : they were deficient all through September and the rice suffered, while a heavy storm in October injured the rest of the late crops. It secured however a very large rabi area for 1905. January of this year was damp and the wheat suffered from rust, while the exceptional frosts of February affected all crops but especially the pulses. The monsoon of this year was on the whole favourable, but floods on the Karamnasa caused considerable damage to property. The rabi of 1906 suffered from untimely rain, and in places from hail and frost. The following rains were at first favourable and the early crops did well, but rice suffered from drought, and the rabi area of 1907 fell below the high level of previous seasons : this crop was damaged by excessive rain in February and March.

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The rains of 1907 lasted into the first week of September; but the dry winds that ensued caused great injury, and most of the late rice was entirely lost. A fair rabi area was sown for 1908 in the north, but it was short in the Ganges tract and very short in the south, especially in the black soils. Germination was in places defective, and the crops were weakened by lack of moisture until the rain came in January. Distress was not severe during these seasons. Test works in the cold weather failed to fill, but a small amount of gratuitous relief was given from January and some aided works were open from March to June: the highest proportion of relief was 0·5 per cent. of the population, which figure was reached in March.

The monsoon of 1908 started well but September and October were much too dry for the rice, and the rabi area of 1909 was below normal. This crop however yielded well and the following rains were sufficient up to September but once again late rice suffered from their early cessation. The rabi of 1910 was successful and the kharif showed a great improvement as the rain lasted into October: a very large area was sown with rabi for 1911 and was again successful, the only failure being poppy, which was seriously injured by the damp weather.

Progress.

The district is fully cropped, and no material expansion can be expected, though the rabi area varies from year to year according to the extent to which the rice-lands can be re-sown.

The class of cropping is very poor and has deteriorated substantially in the last two decades. The small wheat area is on the whole maintained, but sugarcane has fallen off and indigo has disappeared, while no new crops have become important. Poppy extended during the earlier part of this period but has now fallen to about 10,000 acres. As regards food crops, it is noticeable that maize, though extending, is very much less grown than in Jaunpur or Ballia.

Construction of masonry wells has been fairly active, and their numbers increased between 1905 and 1911 by 15 per cent.; there is now one such well to 33 acres of normal cultivation as against 39 acres in 1905, but the district is not yet so well equipped as Jaunpur.

The population has declined progressively in the last two decades, and in 1911 it stood at 840,000 as against 1,025,000 in 1891.

Agricultural wages have risen somewhat in the last five years, and in 1911 the prevailing rates lay between 1½ and 2¼ annas.

Advances for land improvement were taken fairly regularly though to a small amount between 1897 and 1906. There was a large extension during the famine, and half a lakh has been given during the last two years. Advances for temporary purposes are not as a rule considerable, but large sums are required in unfavourable seasons.

Some progress has been made towards the introduction of agricultural co-operation. In 1911 there were five rural credit societies with over 500 members; their organisation was however faulty, and they are now being remodelled as single-village societies, while an organisation society has been founded, which is expected to develop into a district bank.

The system of communications has been very greatly improved during the last ten years. Until 1898 there was no railway in or near the district north of the Ganges, but in the interval the Bengal and North-Western Railway has opened the line from Benares to Ballia passing through Ghazipur and those from Aunrihar to Mau and Jaunpur. In 1911 there was one station to 61 square miles as against 731 square miles at the earlier period. The system of metalled roads has not been extended beyond short lengths to some of the railway stations.

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Rents have shown practically no movement in the period since 1902 for which comparative figures are available. Rents paid by recorded occupancy tenants give a rate which has remained steady at Rs. 4·0 an acre, while other rents have risen slowly from Rs. 5·4 to Rs. 5·7 an acre.

The industries of the district have on the whole declined. Indigo, which used to give seasonal employment to some thousands of labourers, is now scarcely grown, and cotton-weaving, perfumery and sugar-refining have all decreased under the stress of competition. Saltpetre manufacture is more flourishing but is not extensive; and the only organised industry is the government opium factory which affords much employment to the city and neighbourhood.

Income from external sources is less important than in most of the neighbouring districts. The amount distributed annually in money-orders is now about 16 lakhs, as compared with about 12 lakhs at the beginning of the century.

Dangers and possible remedies or improvements.

1. The area under kharif crops other than late rice and sugarcane depends mainly on the weather during the first month of the season. It is an advantage that the rains should begin early: but the main condition for a large area is that once the ground is well wet the falls of rain should not be very frequent and should be separated by intervals of bright weather. Continuous rain during this period will lead to a reduced area of millets and maize, which will be compensated only to a limited extent by an increase of early rice.

The area on which late rice is transplanted depends mainly on the weather in the second month of the season: frequent heavy falls are required with cloudy weather in the intervals. If the rain is insufficient the area will fall, especially in Mahaich and in the north of the district where this crop is most important.

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The area under sugarcane depends to a limited extent on the weather in February and March as rain at this time facilitates tillage, but economic causes are much more important; the area depends partly on the yields and prices of recent seasons, and partly on the resources of the cultivators, that is on the success of the preceding harvests.

2. The yield of the small millets and maize depends on suitable weather during the first two months of the season: a good season for transplanting rice is ordinarily too wet for these crops. The early rice will thrive when the weather is too wet for the dry crops, but will probably give a somewhat deficient yield when these are most successful.

The late dry crops depend mainly on moderate rain prolonged throughout September: their yield will be reduced either by excessive rain or by its premature cessation. The late rice requires fairly heavy rain lasting well into October, and if both September and October are dry it must be expected to fail almost completely.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

In the greater part of the district the cropping is fairly well balanced. The most favourable season is one of moderate falls prolonged to the end of September: heavy rain in the early half of the season may reduce the yield of the early millets and maize, while the late dry crops will suffer from either a very dry or a very wet September. The late rice-tracts require much more rain, first in the transplanting season and then in September and October, and they require careful watching if dry weather sets in in September.

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3. Apart from variations in the rainfall, experience indicates the following dangers to the kharif:—

(a) Floods on the Ganges injure the kharif in the lowlands. This is usually made good in the following rabi, but if the floods are prolonged late in the season sowings may be hindered. Ordinarily no action is required beyond postponement of part of the revenue to the rabi: but in some cases advances may be desirable.

(b) Floods on the Karamnasa may cause such injury as to require postponement of the revenue and offer of advances: advances will be required in particular if homesteads have been destroyed or working cattle drowned.

(c) Sugarcane may be injured by the cane-hopper (see Provincial Note, section VI).

4. The rabi area depends mainly on the rainfall of the latter half of September and the beginning of October. Drought at this time causes a serious fall in the area sown in the southern tract, and also in those parts of the northern tract where clay predominates. In the Ganges tract the rabi area usually falls if there have been no floods.

5. The rabi outturn depends relatively little on winter rain provided the seed-bed has been sufficiently moist. Falls in December and early January are beneficial provided they are moderate and of short duration: falls in February and March are ordinarily injurious, while continued damp and cloudy weather in January and February must be expected to bring on rust on the cereals and on linseed, and may cause very serious loss, the extent of which may not be fully realised till the crop is harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of

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winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring at the usual time, the first half of January, does little harm except to the *arhar*, but a late frost must be expected to cause substantial injury to cereals or pulses or both: the effect on particular crops varies according to their stage of development at the time. The extent of injury from hailstorms also depends largely on the stage of development, but as a rule it increases as the season advances. The only serious injury reported from insect-pests is that caused by the aphis to rapeseed: it spreads to a dangerous extent if damp weather occurs while the plants are in flower. The poppy may suffer severely from damp weather late in the season.

7. The area sown with *zaid* crops is very small, and no causes of injury to them have been reported.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts; no actual failures have been reported, but the supply has fallen off considerably in the recent dry years.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be more noticeable in the loam than in the clay.

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9. So far as past experience shows the need for relief measures will arise only in the event of a premature cessation of the rains, and even this condition has not in recent years produced widespread distress. The following action was taken in the drought of 1907-8:—

	Rs.
Revenue suspended kharif	82,000
" " rabi	9,000
Revenue remitted	Nil.
Improvement loans...	¾ lakh.
Advances for rabi	1¼ "
" " kharif	15,000

Maximum percentage of population relieved 0·5 in February.

10. Experience is wanting to show the conditions under which a serious shortage of fodder may occur, but apparently both August and September must be dry to cause a dangerous position. Should a shortage occur the only measure that can be suggested is importation of grass from the forests.

11. As regards improvement of the water-supply, there is still apparently much scope for sinking more masonry wells, and steady pressure is required in the villages where the need exists. Other possibilites are :—

(*a*) Embankments in the rice-tracts (see Provincial Note, section III.)

(*b*) Field embankments in the black soils of the southern tract (see Provincial Note, section II).

12. There appears to be no need for any drainage that would be practicable.

13. In order to prevent loss from cattle-disease, it is most desirable that close attention should be given to the enforcement of the system of reporting outbreaks of disease prescribed in the Land Records Manual, and sufficient veterinary staff should be maintained to localise outbreaks where they occur.

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14. The district is not well supplied with agricultural capital, and pending the development of co-operative or other sources of supply, the *takavi*-system should be generously worked. Improvement loans are likely to be required for (1) masonry wells, (2) embankments in the rice-tracts, and (3) possibly field-embankments in the *karail* soil; while agricultural loans may be desirable in the following cases:

(*a*) after floods on the Ganges and Karamnasa (vide paragraph 3 above),

(*b*) on the occurrence of losses by cattle-disease; in this case it is important that the loans should be available in time to provide cattle for the next sowing season,

(*c*) on a large scale after an early cessation of the monsoon. There is likely to be considerable demand for seed, wells and incidental expenses in October; further loans may be required in June for the kharif, especially to replace losses of cattle; while smaller sums may be needed about February to plant sugarcane and extend the *zaid* area,

(*d*) in the event of curtailment of the poppy crop, it may be desirable to offer advances in villages where this crop has been important in order to enable the cultivators to substitute some other remunerative crop.

15. The resources of the majority of cultivators are so small that there is comparatively little hope of securing improvement in agriculture through the unorganised action of individuals. The most suitable improvements at the present time are (*a*) better varieties of staples at present grown, when these have been determined by the agricultural department; and (*b*) new crops that may be found suitable, requiring for their success the labour of the family rather than increased outlay in cash.

Ghazipur.

It appears probable that the development of the co-operative organisation will furnish the best means of effecting improvements by associated action.

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DISTRICT NOTE.

BALLIA.

Topography.

THERE are two main divisions, the uplands and the lowlands.

The uplands.—This tract includes parganas Bhadaon, Lakhnesar, Kopachit (east and west), nearly the whole of Sikandarpur (east and west), half of Kharid, and a small portion of Ballia. The soil is usually productive loam stiffening to clay in the depressions: there is some sand but it is of superior quality. Rice is the most important kharif crop, occupying about half the area in that season. The rabi area varies to a considerable extent in different years, being greatest when there has been heavy rain early in October.

The tract as a whole is not liable to flooding, but damage is frequently caused in Sikandarpur west and Bhadaon along the course of the Sarju river, and to a less extent in the neighbourhood of the various *jhils*. Proposals for improvement have fallen through owing to the divergent interests of different areas.

The lowlands.—This tract includes pargana Garha and nearly all of Ballia, which lie on the Ganges: half of Kharid with small portions of the two Sikandarpurs which touch the Gogra; and Duaba, which lies between the two rivers.

The land lies low, but considerable areas are stable and very fertile. The confluence of the two great rivers close to the edge of the district results in enormous deposits of silt. The Ganges silt is usually very fertile, though occasionally sand is deposited in large quantities: the kharif crops sown

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are maize and small millets, which can often be gathered before the floods, but the kharif is somewhat speculative. The area and yield of the rabi depend mainly on the floods of the previous season. The Gogra silt is generally sandy and not infrequently is quite infertile: and in this case a flood does not mean a good rabi except by accident. The course of the Ganges shifts within wide limits, and accretion or erosion of entire villages is a normal feature; the Gogra does not shifts so far but it tends to form large islands.

Water-supply.

The lowlands are not irrigated even in years of drought: the area sown with rabi depends mainly on the quality of the flood, and whatever can be sown is usually secure. In the upland the *jhils* and *tals* are fully utilised: these are found throughout the tract but are most numerous in the west. Proposals have more than once been made to systematise and develop the irrigation from the large Suraha Tal in the north of Ballia, but nothing has been done owing to the numerous divergent interests. Wells are the most important source of irrigation in the uplands. Temporary wells can be made in very many villages (which are recorded in the well-survey), and there is a wide scope for advances for their construction in years of drought. Masonry wells are numerous: their construction is popular, and scarcely any hostility to them has been recorded. Foundation clay is generally met with, except in Kharid and Ballia, and in a few villages elsewhere. The district authorities who compiled the well-survey did not consider that there was urgent need of many more masonry wells, but construction has gone on rapidly in the interval.

Cattle-supply.

The stock of cows is proportionately very large for a plains district, a fact which is probably connected with the large number of Ahir cultivators. The cows are not grouped in large herds but are owned in small numbers by landholders

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and cultivators: the supply of bulls for breeding appears to be adequate, and the quality of the stock is superior to that in the adjoining districts. Owners give the calves a considerable share of the mother's milk, and generally tend them carefully, while special efforts are made to have them well turned out for sale at the great Dadri fair. The district produces most, if not all, of its working stock: probably there is a surplus, which is distributed through the fair to adjoining districts.

The district is liable to all the common forms of cattle disease. Rinderpest has in the past caused serious losses, but there has been little in recent years. The attitude of the people towards the practice of inoculation is still uncertain, as there have been few opportunities of testing it owing to the absence of outbreaks.

Annals.

There are few records of serious calamities in the years previous to 1894-95 when the first regular report was submitted. There was some distress in the famine years of 1868-69, 1873-74, and 1877-78, but as a rule it was not acute. In 1889 there were exceptionally high floods on the Gogra which led to temporary distress. In 1895 rain was insufficient for the rice, and the rabi area of 1896 was generally contracted. The following rains ceased in August, and rice was reported to be almost a total failure; the other kharif crops were, however, very fair, and though the rabi area of 1897 was further reduced the yield was good. The district required no general relief measures during these seasons.

The excessive rain at the beginning of the monsoon of 1899 reduced the kharif area by about 12 per cent. in the uplands and 40 per cent. in the lowlands, and much of what was sown in the latter tract was seriously injured. Floods occurred along the Sarju in the upland, and rinderpest was prevalent. In the following cold weather hailstorms of unusual extent and severity caused general loss to the rabi and altogether these seasons were unfavourable.

Ballia.

In 1900 there were again floods on the Sarju, but the kharif was generally good. The rabi of 1901 suffered much from excessive damp: both wheat and barley were seriously affected by rust, and the pulses were attacked by caterpillars. The district, which had hitherto been without railway communications, was now being opened up by the Bengal and North-Western Railway extensions, and a programme of feeder roads was being gradually carried out.

In the following kharif rice was damaged by deficient rain at the end of the season, while the year 1902 was favourable all round.

The seasonal yields since 1903 are given in the following table: they are probably comparable among themselves, though generally pitched too low:—

Year.	Rabi.				Kharif.			
	All crops.	Barley.	Gram.	Peas.	All crops.	Rice.	Small millets.	Sugarcane.
1903 ...	82	88	81	81	80	87	75	75
1904 ...	94	100	87	87	75	75	75	87
1905 ...	73	87	75	62	60	55	55	87
1906 ...	79	75	81	81	53	50	69	81
1907 ...	69	69	75	69	52	17	75	50
1908 ...	81	87	81	75	77	50	87	62
1909 ...	90	94	87	87	86	79	90	81
1910 ...	90	87	94	94	86	94	81	94
1911 ...	94	87	100	100	...	...	...	...

In 1903 the rabi was good, but the kharif crops other than rice were affected by irregular rainfall, which was in defect in July but excessive in October. Rabi sowings for 1904 were large and the yield was good. The following rains were again uneven; there was too little rain in August and September and heavy falls in October injured the late millets. An exceptionally large area was again sown for the

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rabi of 1905: the frosts of February injured *arhar* and peas seriously and other crops to a less extent. The rains of this year were heavy, and there were high floods on the Gogra: almost all crops were inferior, but in the case of rice the cause of the low yield is not on record. In 1906 the winter rains were late and excessive when they arrived, and the crops suffered from both causes. The monsoon was not good: rain was excessive in August and injured the dry crops, while there were exceptional floods on the Gogra; September, on the other hand was too dry for rice. The rabi of 1907 suffered from rain at the end of the season and there was some rust on cereals. The following monsoon practically ceased at the end of August: late rice was entirely lost, and sugarcane and other late crops suffered seriously. Rabi sowings for 1908 were reduced by about one-fourth, and the crops suffered from want of moisture until the winter rains fell. There was slight distress during these seasons: gratuitous relief was given between January and May, while some aided works were opened, but the highest number on relief was only 0·5 of the population.

The rains of 1908 were irregular: in July and August they were too light for rice, which also suffered seriously during a long break in September, falls at the end of this month coming too late for the crop. Sugarcane was affected by drought and also by the cane-hopper. The rabi of 1909 was somewhat short in area, but yielded well: the monsoon was good up to the end of August, but afterwards the rains were insufficient for late rice. The rabi of 1910 was again good though barley was injured by rust, and the monsoon was favourable, though there were exceptional floods on the rivers. The rains lasted well into October and in consequence the largest rabi area on record was sown for 1911; barley was slightly affected by rain in March, but the yield all round was exceptionally good.

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Ballia.

Progress.

The district has for long been fully cultivated and there has been no expansion during the last two decades though the area cultivated varies widely from year to year. The land is mainly devoted to food crops, and the proportion of remunerative crops is low and has fallen in the last two decades. The small wheat area has been maintained, but sugarcane shows a substantial decrease, and cotton, which twenty years ago occupied about 6,000 acres, is no longer grown. The poppy area also is being reduced, and the only sign of progress in cropping is a slight extension of potatoes. Among food grains maize extended until 1903 when the area exceeded 60,000 acres but somewhat less has been sown in recent years.

Correct figures for the number of masonry wells are available only since 1907. Between that year and 1911 the number of such wells increased by 15 per cent., and in 1911 there was one to 35 acres of normal cultivation as against 40 acres in the earlier year. Allowing for the large lowland areas the figure is high but does not indicate complete protection: the recent rapid increase appears to show that the taste for these wells is growing.

The population of the district is decreasing and in 1911 stood at 845,000 as against 995,000 in 1891.

Agricultural wages appear to have risen slightly in the last five years, but very low rates are still found: the rates recorded in 1911 ranged from one to two annas.

Loans for land improvement were practically unknown in the district until 1906. Over one lakh was however distributed during the famine of 1907-8, and since then a demand has apparently arisen, an aggregate of nearly half a lakh having been taken in the last three years. Loans for temporary purposes have of late been taken freely in adverse seasons. There has been no development of agricultural co-operation in the district.

Ballia.

As lately as 1897 the district had no railway communication, and depended on the rivers for most of its external trade. The existing railway system was brought into use between 1898 and 1903, and provides a station to every 78 square miles. There may still be room for a line along the north of the district, but all other portions are adequately served. Metalled roads are still scarce, but a substantial advance has been made by the metalling of the Ballia-Bansdih and Phepua-Rasra roads, while the Ballia-Sikandarpur road is being gradually metalled.

Rents are low and the rent-rate shows practically no movement since 1903, when comparative figures first became available: the rate for recorded occupancy tenants has stood between Rs. 4·0 and Rs. 4·2 per acre, while that of other tenants has risen from Rs. 4·1 to Rs. 4·2. The lowness of the rates is due to the fact that nearly all the best land is cultivated by the owners, while the tenants of the larger estates are strong and cohesive bodies.

The only modern industry in the district is a small flour mill recently started in Ballia town. The indigenous industries of sugar refining and weaving have suffered greatly from competition though they are still important: the saltpetre industry has apparently expanded.

The district derives a considerable income from persons in service beyond its limits. This is understood to be the main source of the sums distributed by money-orders, which are now about 19 lakhs annually as against 12 lakhs at the end of the last century.

Dangers and possible remedies or improvements.

1. The area under kharif crops other than late rice or sugarcane depends mainly on the weather during the first month of the season. It is an advantage that the rains should begin early: but the main condition for a large area in the upland tract is that once the ground is well wet the falls of

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rain should not be very frequent and should be separated by intervals of bright weather. Continuous rain during this period may be expected to lead to a reduced area of millets and maize, which will be compensated only to a limited extent by an increase of early rice. The lowlands require the same type of weather, and in addition the absence of early floods on the rivers.

The area on which late rice is transplanted depends mainly on the weather in the second month of the season: frequent heavy falls are required, with cloudy weather in the intervals. If the rain at this season is sufficient the area will be reduced in the upland tract where the crop is of much importance: it is not largely grown in the lowlands.

The area under sugarcane depends to a limited extent on the weather in February and March as rain at this time facilitates tillage, but economic causes are much more important; the area depends partly on the yields and prices of recent seasons, and partly on the resources of the cultivators, that is on the success of the previous harvests.

2. The yield of the small millets and maize depends on suitable weather during the first two months of the season: a good season for transplanting rice is ordinarily too wet for these crops. The early rice will thrive when the weather is too wet for the dry crops but will probably give a somewhat deficient yield when these are most successful. In the case of the lowlands, the chief crops, maize and small millets, are liable to destruction by flood and are to a large extent speculative.

The late dry crops, which are of little importance in the upland and are not sown in the lowlands, require moderate rain prolonged throughout September. The late rice, which is of great importance in the upland, requires fairly heavy rain lasting well into October, and if both September and October are dry it must be expected to fail almost completely.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

The most favourable season for the upland tract is one of rather light rain at first with heavier rain prolonged into October: for the lowlands the later part of the season is of little importance, the main question being whether the early part allows the maize and millets to mature before the floods.

3. Apart from variations in the rainfall and in the period of floods on the main rivers, the following causes have injured the kharif:—

(*a*) *Floods in the upland along the course of the Sarju and in the neighbourhood of the* jhils. The effects of these are local, but may be so severe as to require the offer of loans to enable the rabi to be sown.

(*b*) *Injury to sugarcane by the hopper.* (Vide Provincial Note, section VI.)

4. The rabi area in the upland depends mainly on the rainfall of the latter half of September and the beginning of October; drought at this season leads to a substantial falling off. The lowlands are comparatively independent of the local rain; the area sown on them depends on the quality of the silt-deposits and the time at which the floods finally recede.

5. The rabi outturn depends relatively little on winter rains provided the seed-bed has been sufficiently moist. Falls in December and early January are beneficial provided they are moderate and of short duration: falls in February and March are ordinarily injurious, while continued damp and

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cloudy weather in January and February must be expected to bring on rust on the cereals and on linseed, and may cause very serious loss, the extent of which may not be fully realised till the crop is harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance to the upland. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost is not usually expected, and the conditions in which it will cause serious injury are not well known. It occurred at the end of January and the beginning of February 1905 and affected the pulses in particular: and probably serious results will follow its occurrence after the middle of January.

The extent of injury from hailstorms depends on the stage which the crops have reached; as a rule it increases as the season advances.

Gram and peas are sometimes attacked by the caterpillar known as the *deula*; the conditions favouring this pest are not accurately known.

The rapeseed crop may suffer severely from the aphis if damp and cloudy weather occurs while the plants are in flower.

The poppy crop is liable to much injury from damp weather late in the season.

7. The area sown with *zaid* crops is not large, and no sources of injury to them have been reported.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are

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materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts of the uplands but no such occurrence has been reported.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the uplands.

9. The district has no experience of severe distress, which could apparently be brought about only by entire failure of the rains or by a succession of disastrous seasons. Slight distress may be caused by premature cessation of the rains, if the late rice in the uplands is lost; this occurred in 1907, when the following relief measures were found sufficient :—

Revenue suspended, kharif	Rs. 35,000
,, ,, rabi	,, 13,000
Revenue remitted	Nil.
Improvement loans	1½ lakhs.
Advances for rabi	2½ ,,
,, ,, kharif	¼ lakh.

Maximum percentage of population relieved 0·5 in February.

10. Experience is wanting to indicate the conditions under which a serious shortage of fodder may occur, but the contingency is very improbable. Should it occur importation of grass is the only measure that can be suggested.

11. As regards improvement of the water-supply, there is still apparently scope for the construction of numerous masonry wells in the upland, and the existing policy of providing capital for these should be maintained. Other possibilities are :—

(*a*) *Embankments in the rice tracts of the uplands.* (See Provincial Note, section III.)

(*b*) *Improvement of irrigation from the Suraha Tal.* This question has recently been examined by

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the Irrigation department and it has been decided that regular irrigation channels are not required, but that the supply of water can be greatly improved by providing a regulator in the channel connecting the lake with the Ganges.

12. The regulation of the floods on the lowlands is probably not feasible, and all that can be done is to assist cultivators to make the best of the position by offering loans when required.

There are admittedly great difficulties, due to conflicting interests, in improving the drainage of the uplands; but this tract should receive attention in any examination that may be made of the drainage-system of the Ganges-Gogra doab.

13. In order to prevent loss from cattle-disease, it is most desirable that cultivators should be familiarised with the practice of preventive inoculation, and that the leaders of the people should be convinced of its advantages. Attention should also be given to securing prompt reports of outbreaks under the rules laid down in the Land Records Manual, and sufficient veterinary staff should be maintained to localise outbreaks where they occur.

14. The district is not well supplied with agricultural capital, and pending the development of other sources of supply, the *takavi*-system should be generously worked. Improvement loans are likely to be required mainly for masonry wells and for embankments in the rice-tracts, while agricultural loans may be desirable in the following cases:—

(*a*) On a large scale in the event of premature cessation of the rains. There is likely to be a considerable demand for sowing the rabi; possibly a further demand in the early spring for sowing sugarcane and *zaid* crops; and again in June to sow the kharif, and particularly to replace dead cattle.

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(*b*) In the lowlands when the kharif has been destroyed by floods.

(*c*) On the occurrence of losses by cattle-disease: in this case it is important to make the loans available in time to provide cattle for the next sowing season.

(*d*) If the poppy area is curtailed, it may be desirable to offer advances in villages where the crop has been largely grown to enable the cultivators to substitute some other remunerative crop.

15. The resources of the majority of cultivators are so small that there is comparatively little hope of securing improvement in agriculture through the unorganized action of individuals. The most suitable improvements at the present time are the introduction of (*a*) better varieties of staples at present grown, where these have been determined by the agricultural department; (*b*) new crops that may be found suitable, requiring for their success the labour of the family rather than increased outlay in cash.

Experience is wanting to show whether agricultural co-operation will develop so as to furnish an effective agency for improvement by associated action; no alternative agency can be suggested.

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DISTRICT NOTE.

GORAKHPUR.

Topography.

THE district is not homogeneous, but the pargana boundaries do not coincide with the natural divisions, and as topographical assessment circles were not framed at settlement, the limits of the tracts can only be indicated approximately. There are five of these, which may be called the *bhat*, the northern rice, the centre, the river tract, and the western loam.

1. *The bhat.*—This tract forms the eastern part of the district and is bounded on the west approximately by the line of the Little Gandak; it thus includes the whole of pargana Sidhua Jobna (tahsil Padrauna), with the east of Tilpur and of Shahjahanpur; the eastern block of Salempur-Majhauli is of the same type but is separated from the rest of the tract by a portion of the Saran district. The soil of this tract differs in a marked manner from the ordinary alluvial soil of the provinces; it contains a much larger proportion of lime, and its chief characteristic is its power of retaining moisture, so that irrigation is required only for special crops or in exceptional seasons. It is not altogether homogeneous; the description just given applies to most of the level land, but a heavier soil is found in the drainage lines and a lighter soil (known as *dhusi*), containing a good deal of sand and requiring water more frequently, is found on the high banks of the streams and on ridges elsewhere. Rice is largely grown, but sugarcane, maize and rabi crops are also important. There is some lowland known as *dhab*, where the Great Gandak touches the eastern part of Sidhua Jobna; this land depends mainly on the rabi.

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The Great Gandak is subject to very high and sudden floods, and spill-water from them reaches the Rohin, the Little Gandak, and other rivers at various points, so that the Gandak silt is distributed widely over the tract. The kharif crops mature very early in this part, and the floods do not as a rule last long so that there is less risk of injury to the kharif than is the case on the Ghagra and Rapti.

2. *The northern rice tract* includes the greater portion of tahsil Maharajganj, viz. the whole of pargana Binaikpur, the greater part of Tilpur, and the northern part of Haveli-Maharajganj; but no definite limit can be laid down as the transition from *tarai* to ordinary upland is gradual.

The Himalayan foothills lie a short distance to the north of the boundary, and the *bhabar* formation lies outside the district. The northern part of tahsil Maharajganj consists of *tarai*, which passes gradually through heavy clay into the loam that characterises the central tract. There are extensive sal forests, some reserved and some in private hands; considerable damage is caused by wild animals in their vicinity. There is much cultivation in the *tarai*, but the climate is unhealthy, and much of the cultivation is inferior.

Rabi is comparatively little grown, while 90 per cent. of the kharif is rice. In parts of Binaikpur, where private irrigation works exist, the valuable later rices are largely grown; elsewhere the early rices predominate.

3. The central tract lies between the rice tract on the north, the *bhat* on the east and the basin of the Rapti and Gogra on the west and south; it includes the greater part of the old Haveli pargana (the south of Haveli-Maharajganj, the east of Haveli-Gorakhpur, and the whole of Haveli-Hata); nearly the whole of Sylhat and Salempur-Majhauli, and the west of Shahjahanpur. The prevailing soil is loam; in the north it is heavy and there is much clay in the depressions, but it gets lighter towards the south till in Salempur-Majhauli

clay is comparatively rare and sand is frequently found. The cropping follows the soil: in the north the kharif predominates and most of it is rice (usually the early varieties): going southwards, the proportion of the kharif devoted to rice falls, the rabi area increases in extent, and the class of crops improves.

4. The river tract includes the basin of the Gogra and the Rapti. The Rapti flows between Haveli-Gorakhpur, Sylhat and Salempur Majhauli on the east, and Maghar, Bhawapar and Chillupar on the west; the Gogra bounds the district on the south passing along Dhuriapar, Chillupar and Salempur-Majhauli. The lowlands are not very extensive; they are subject to erosion and to the deposit of silt, which is usually fertile but occasionally injurious. Where kharif is grown, early crops are sown in the hope that they may be secured before a flood; the rabi does not require irrigation, and the greatest dangers to it are (1) the occurrence of floods so late as to interfere with rabi sowings, and (2) the deposit of sterile silt.

5. The western loam includes those portions of parganas Maghar, Bhawapar, Unaula, Dhuriapar and Chillupar which lie outside the river basins. The soil is a light, fertile loam with clay in the depressions and sand along the streams. Rice is the most important crop, but the cropping is varied.

Water-supply.

The *bhat* tract ordinarily requires little irrigation, even sugarcane being grown without it; the porous nature of the soil involves much loss by seepage from the water channels, and the belief is prevalent that the soil deteriorates under irrigation. Irrigation in the rabi season is therefore almost confined to garden crops which are watered from wells in the sites, while rice is watered from rivers and similar sources. Temporary wells cannot usually be made owing to the friable nature of the subsoil. There is very little accurate knowledge regarding the existence of foundation clay, and there is not much scope for the construction of masonry wells.

In the northern tract, where the rabi is of comparatively little importance, wells are not much used. There are some villages in pargana Tilpur where temporary wells can be made, while practically nothing is known as regards the existence of foundation clay. The rice crop is irrigated from streams and *jhils*: in pargana Binaikpur the irrigation from streams is systematised, and may be classed as canal irrigation, but the Nepal Darbar has raised objections in some cases to the existence of the dams as the drainage of the state is adversely affected. The Irrigation department has recently examined the prospects of government canals in this tract and decided that they are not required.

Irrigation from *jhils* is important throughout most of the central tract, but there is much rabi irrigation from wells. Temporary wells can be made in a large number of villages, (which are recorded in the well-survey), while masonry wells are numerous. These masonry wells are very cheap and are ordinarily supplied by percolation: they are worked by lever, and do not afford protection over nearly so large an area as the spring wells in the country to the south of the Ghagra, but they serve their purpose on the whole satisfactorily. Knowledge regarding foundation clay is very scanty: spring wells are known to exist in the south of tahsil Hata and in a large part of tahsil Deoria, and they may be possible elsewhere though the fact has not been discovered by the people. There is still room in this tract for very large numbers of masonry wells. A proposal was made to carry a canal from the Great Gandak across this tract, but it has been dropped after detailed examination by the Irrigation department.

The river tract does not ordinarily require irrigation. There are naturally few masonry wells, and the localities where temporary wells can be made are few: but streams and

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lakes are largely used when required. In the western loam conditions are generally similar to the central tract, but spring wells appear to be very rare and probably foundation clay is absent from most of the tract. The villages where temporary wells can be made have been recorded in the well-survey.

Cattle-supply.

The stock of cows in the district is relatively large, and the supply of bulls is adequate. The cows are not concentrated in large herds, but most of them are found in the northern half of the district, where there is extensive grazing in the forests (both reserved and private). The majority of the owners appear to think of milk and *ghi* rather than of young stock: the cows are inferior and yield little milk, and the stock is equally inferior.

Better class working cattle are imported from Bahraich and further west, or from the Sonepur or Dadri fairs.

The district is liable to all the common forms of cattle-disease: there is as yet no demand for preventive inoculation.

Annals.

The district has usually escaped lightly in seasons of drought, and up to 1895, when regular reports were first submitted, the only records of distress from this cause relate to 1874 when it was somewhat severe, and to 1878 when it was slight. On the other hand the records of floods are numerous: they were most severe in 1871, 1873, 1889 and 1892. The first report recorded another very severe flood in the wet season of 1894. In 1895 the rains ceased prematurely and the late rice suffered: while in 1896 the failure was more pronounced, late rice being almost entirely lost and all other kharif being injured. The rabi area of 1897 was much reduced everywhere except in the *bhat* and in pargana Salempur. Distress was felt during these seasons in tahsils Gorakhpur, Bansgaon and Hata as well as in part of Maharajganj, and relief works were open from January till June.

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There were again floods in 1898; while in 1899 the early crops were damaged by excessive rain and the late rice by drought in September. The rains of 1900 were at first so deficient as to interfere with transplanting rice, but they lasted well. The winter rains of 1901 were excessive and the cereals suffered somewhat severely from excessive moisture and from the damp and cloudy weather. The following monsoon was sufficient for all crops except late rice, which was injured by a break in September; there were practically no winter rains and the rabi suffered in consequence. The rains of 1902 were generally sufficient, but late rice again suffered from want of rain at the end of the season. The seasonal yields since 1903 are given in the following table:—

Year.	Rabi.						Kharif.			
	All crops.	Wheat.	Barley.	Gram.	Peas.	Linseed.	All crops.	Rice.	Small millets.	Sugarcane.
1903	81	88	88	69	69	81	85	90	81	94
1904 ...	77	75	75	84	84	75	69	71	56	87
1905 ...	53	56	56	69	44	44	72	81	50	75
1906 ...	78	75	75	81	81	75	50	53	43	100
1907 ...	67	56	75	75	62	62	65	55	94	100
1908 ...	79	94	94	50	62	50	78	69	94	81
1909 ...	82	87	94	81	81	69	94	94	94	94
1910 ...	95	94	94	94	100	94	77	81	62	100
1911 ...	106	81	125	100	125	100	...	...	...	...

The rains of 1903 began late, but were heavy in August when the millets suffered and floods injured the river tract. Rain in October did some harm to the late kharif but benefited late rice and sugarcane, and enabled a very large area to be sown for the rabi of 1904. The yield of this was however only moderate though no special injury was recorded. The following rains were so heavy in July and August as to cause severe injury to the millets, while September was too dry for the late rice. This crop however was saved by rain in

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October which also enabled a full rabi area to be sown for 1905. This season was however unfavourable: January was wet and rust appeared on wheat, while there was local damage from hail. The exceptional frosts in February damaged all crops but especially peas and linseed. The rains of 1905 were late, but at first heavy and the rivers were in flood: there was not enough rain for late rice in October. The rabi of 1906 was damaged by rain in February.

The rains of 1906 were disastrous. Heavy rain continued for 25 days from 28th July: the kharif in the lowlands was entirely destroyed by extraordinary floods, and the *bhat* soil became over-saturated. The later part of the season was dry and the late crops suffered throughout. Special efforts were made to secure a good rabi area for 1907, advances being given and arrangements made for supplying sound seed: the area was fairly maintained, but there was too much rain for all crops in February and March, and wheat in particular was damaged by rust. Relief works were open during this season for the benefit of the *bhat* and river tracts, but they were not largely attended as labourers found employment in other parts of the district.

The following monsoon was light and ceased early: there were no floods and the *bhat* and river tracts obtained good harvests: in the rest of the district the rice, especially late rice, suffered severely. The rabi area of 1908 fell off, especially in the river tract where preliminary irrigation was impossible, and the crops suffered from want of moisture until rain came in January. Later there was some damage from hail. In this district these seasons, which were so disastrous elsewhere, were described as a period of recovery, and no measures of relief were required.

The rains of 1908 were insufficient for rice, and sugarcane had suffered in the early stages of growth: while there was not sufficient moisture to sow a full rabi area for 1909, especially in the central tract. In this year the rains were good: there were heavy losses of kharif in the river tract, but elsewhere the crops did well and a full rabi was sown for 1910. The winter rains were sufficient in December and January, and the dry weather that followed ensured good yields. The rains of 1910 were excessive for all crops except rice: and the river tract again lost its kharif: but the following rabi area was the largest on record, and also gave the best yield despite the injury caused to wheat by rust.

Progress.

The cropped area of the district has risen substantially in the last two decades:* the extension has been greatest in the north of the district, and there is room there for further expansion, which however would result in a contraction of the area available for grazing. The proportion of remunerative crops has remained approximately constant: indigo has fallen but a substantial area is still sown, while sugarcane has extended in the north, and the wheat area has been maintained. The area under poppy was constant until the last few years during which it has been reduced by one-half.

The statistics of masonry wells in the district are less accurate than usual, but there is no doubt that construction has proceeded rapidly in late years. In other respects irrigation facilities have not been increased materially.

The population of the district fell somewhat between 1891 and 1901 but has risen substantially in the last decade: in 1911 it stood at 3,201,000 as against 2,994,000 in 1891.

Agricultural wages show little change in the past five years: the cash rates recorded in 1911 lay between one and two annas; grain-rates have however risen in some instances and give rates as high as 2½ annas.

Advances for land improvement were practically unknown in this district until 1907-8: in that year nearly half a lakh was advanced, while small sums were taken in 1909-10, and over Rs. 10,000 in 1910-11. It is not yet possible to say whether a regular demand for these loans is arising. Loans for temporary purposes are appreciated when the seasons are unfavourable, and large sums were taken between 1905 and 1909.

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* In examining the statistics allowance must be made for the transfer to Azamgarh of a portion of pargana Dhuriapar, which was carried out in 1904.

Agricultural co-operation has made some headway in the district. In 1911 there were two district banks, with an aggregate of over 3¼ lakhs of working capital, and a number of rural credit societies affiliated to them. The organisation is now being changed so as to give greater independence to the rural societies.

The railway system has been extended during the last twenty years by the opening of (1) the line from Bhatni to Benares with the branch to Barhaj, (2) the line from Gorakhpur to Bagaha: there was in 1911 one station to 146 square miles, as against 286 square miles in 1891. Some additional roads have been metalled in the same period and more bridges made: but the road system is still very backward, and the absence of bridges in the north of the district causes communications to be almost suspended during the rains.

The rents recorded in the district are very low, but the figures need not be given here as the records are known to be below the truth, and it is not possible to distinguish the actual rise from the apparent rise due to improvement in record. The rise is also obscured by the prevalent practice of taking a premium on renewal of a lease.

The rural industries of weaving and indigo manufacture have declined, though the latter still affords a substantial amount of seasonal employment. Sugar-refining is carried on at many centres and does not appear to have declined: while two sugar factories organised on modern lines have recently been established. At the district head quarters the works maintained by the Bengal and North-Western Railway have been greatly extended and in 1911 afforded employment to over 2,000 workmen.

The district derives a large income from earnings outside it: large numbers of labourers visit Bengal every year between October and June, returning home for the rains, and others remain away for longer periods. At present sums aggregating about 20 lakhs of rupees are distributed annually by money-orders, as against about 14 lakhs at the end of the nineteenth century.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area under them will fall, while early rice will extend.

The area under late rice, which is relatively extensive, depends chiefly on the weather during the second month of the season: frequent falls of rain with little sunshine are required, and a long break at this period may lead to a substantial reduction in the area.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

2. The yield of the early dry crops, of which *kodon* and maize are the most important, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

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Gorakhpur.

The late rice requires moderately heavy rain in September, and at least one fall in October is desirable for its complete success. The late dry crops are of practically no importance.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is more beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

The kharif cropping is on the whole well balanced, considering the amount of rain that is usually received: provided the rain lasts long enough for the early rice, the loss to the kharif from drought at the end of the season is limited to the late rice and a small area of miscellaneous crops.

3. Apart from variations in the local rainfall, the chief danger to the kharif arises from floods. Loss may occasionally be severe along the Great Gandak, but it is more frequent on the Gogra and Rapti and their tributaries. The period at which the floods occur is the most important point: maize is the crop most largely sown; it matures rapidly and may be harvested before the floods come, but if the crop is still on the ground serious loss is certain to result.

The experience of 1906 shows that continuous rainfall may destroy the kharif crops in the *bhat* tract, but such an occurrence is probably very rare indeed.

No serious losses from insect-pests have been recorded.

4. The rabi area varies within very wide limits according to the rainfall at the end of the season. Good rain in early October may cause a very large extension while a cessation of the rains early in September will be followed by a serious fall.

5. Winter rains are very beneficial to the rabi up to about the middle of January, provided the falls are moderate and of short duration. Rain in February or early March is

likely to be somewhat injurious, while prolonged periods of wet and cloudy weather in January and February must be expected to produce rust on wheat and linseed. The loss from this cause may be very serious, and its extent may not be fully recognised till the crops have been harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost is rare, and does little harm if it occurs at the beginning of January: but after the middle of the month the danger becomes serious.

Hailstorms early in the season are not of great importance, but the danger of loss increases as the season advances.

The rapeseed crop may be seriously injured by the aphis if damp and cloudy weather occurs while the plants are in flower.

The poppy crop is likely to suffer from damp weather in the latter part of the season.

7. The area under *zaid* crops is locally of some importance, and the grant of advances to enable the people to extend it may be desirable in seasons when the kharif has been poor or the rabi is unpromising.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of percolation wells decreases, while the cost and labour of irrigation are materially enhanced.

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One the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the river tract, and possibly in the *bhat*.

9. Distress requiring some measures of relief must be expected to occur if the rains cease early: it should not be extensive if the early rice has matured, and the river and *bhat* tracts should suffer least. In 1907-8 no direct relief was required but the following measures were taken:—

Revenue suspended, kharif	Rs. 2,000
" " rabi	" 1,000
Revenue remitted, kharif	" 19,000
" " rabi	" 4,000
Improvement loans	½ lakh.
Advances for rabi	1 "

The experience of 1906 indicates that some measures of relief may be required in the *bhat* and river tracts after a season of very abnormal rainfall, but this is likely to be very rare.

10. There is no record of the occurrence of such a shortage of fodder as to require government action on a large scale.

11. The proposals to improve the water-supply of the district by constructing canals have been abandoned, and no suggestions can be offered as regards the northern tract, while the *bhat* and river tracts do not require an additional supply. For the central and western tracts, where there is still room for many more wells, the only action to be taken is the continued provision of loans.

There may also be scope for embankments in the rice tracts (see Provincial Note, section III).

12. There is no demand for drainage works. The recurring losses from floods in the lowlands are serious, but their prevention appears to be impracticable.

GL

Gorakhpur.

13. The question of preserving the remaining private forests for grazing may become important and should not be overlooked.

In order to minimise losses from disease, it is desirable to insist on prompt reporting of outbreaks under the system laid down in the Land Records Manual, and to maintain a veterinary staff sufficient to localise outbreaks when they occur. Endeavours should also be made to educate the people, through their leaders, in the advantages of protective inoculation.

14. The district is not well supplied with agricultural capital: its need can probably be largely met by the gradual extension of the co-operative organisation, but for the present there is considerable scope for the grant of *takavi*. Improvement loans may be wanted for masonry wells, and possibly for embankments. Agricultural loans may be required in the following cases:—

(*a*) *Early cessation of the rains.*—The demand may be very large for sowing rabi, and also for the following kharif; and loans may also be required about February for sugarcane and *zaid* crops.

(*b*) *Floods.*—Advances may be required when the kharif has been injured to enable the rabi to be sown.

(*c*) *Cattle-disease.*—It is important that cultivators should be in a position to replace working cattle before the next tillage-season.

(*d*) *Curtailment of the poppy area.*—Advances may be desirable in villages where the crop has been largely grown to enable cultivators to substitute a remunerative crop.

15. Agricultural improvements requiring associated action may possibly be effected on a few of the larger estates or through the European landholders, but the co-operative organisation is the most promising agency. The cropping of

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the district requires to be examined before suggestions can be made for its improvement, but probably both the wheat and the sugarcane of some portions can be improved substantially. There is probably not much room at present for expensive machinery with the exception of sugarcane-mills, but the cheaper improved implements of tillage should gradually become popular, especially in the river-tract. The district appears to have special advantages for the establishment of a modern sugar-industry.

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DISTRICT NOTE.

BASTI.

Topography.

THE district may be described briefly as follows: a more detailed account will be found in the first chapter of Mr. Hooper's settlement report.

The Gogra lowland.—This tract, known locally as *tarhar*, lies on the south of the district between the present stream of the Gogra and a well-defined high bank.

It consists mainly of a fertile greyish loam. There are occasional patches of poor sandy land; and there are hollows where the ground is waterlogged and the soil is too heavy for anything but rice and is covered in patches with alkali (*reh*); but these inferior tracts are the exception, and the tract as a whole is highly productive.

Irrigation is ample: water is near the surface, wells are easily made, and the *tals* are a fairly safe source, being filled by the overflow of the rivers.

The islands in the various courses of the river are of course flooded in the rains, and yield only rabi: the western portion of the tract does not suffer much from floods, but in parganas Mahuli west and Mahuli east the waters of the Kuano are held up by the Gogra and the low country is flooded, often destroying the kharif, and in some places leaving the ground too moist for rabi sowings.

The tappas affected in Mahuli west are Jagannathpur, Kudarha and Kabra: practically the whole of the lowland in Mahuli east suffers.

The tappas which lie wholly or mainly in this tract are shown below :—

Pargana Amorha.	Pargana Nagar (west).	Pargana Nagar (east).
Tappas.	Tappas.	Tappas.
Pangawan (south).	Naval (south).	Haveli (south).
Sikandarpur.	Manwarpara.	Pilai.
Belwa.		Pipra (south).
Ramgarh.		Kalwari.
Dubaulia.		Kanaila.

Pargana Mahuli (west).	Pargana Mahuli (east).
Tappas.	Tappas.
Jagannathpur.	Muradpur.
Charkaila.	Ajaon.
Kudarha.	Naudand.
Kabra.	Buzurgwar.
Sheobakhri.	Taryapar (south).
	Mahthi.
	Kuchri.
	Taraf Belghatia.
	Sirsi.
	Bargaon (east).
	Simri.

The edge of the upland.—This consists of a ridge running to the north of the tract just described. It is high undulating land, very sandy except in a few hollows, and much less productive than the country to the north and south.

Irrigation is deficient as there are no *tals*, and wells are hard to make and only last a short time. There is no danger from floods.

The tappas which lie wholly or mainly in this tract are shown below :—

Pargana Amorha.	Pargana Nagar (west).	Pargana Nagar (east).
Tappas.	Tappa.	Tappas.
Bangawan (centre).	Nawai (north).	Dubakhra.
Purena (south).		Haveli (north).
		Kurha.
		Pipra (north).

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Pargana Mahuli (west).	Pargana Mahuli (east).	Pargana Mahuli (east).
A few villages in various tappas.	Tappas.	Tappas.
	Chandrauti Muhabra (west).	Satahra. Taryapar (north).

The upland (*uparhar*).—This tract lies north of the foregoing and includes the whole country up to the present course of the Rapti as far east as Bansi, and thence up to the old southern course of the same river. The predominant soil is fertile loam: there is poor sand along the rivers and there are considerable stretches of clay where late rice is the main crop. The principal clay tracts are:—

(1) Tappa Ujiar and the small tappas on the east in pargana Maghar east: (2) Rudhauli and north Gusiyari in Maghar west: (3) Umra in Basti east: (4) south Sagra in Rasulpur.

The north of the tract is distinguished by the prevalence of the soil named *bhat*, which is formed from the silt of the Rapti, and is characterized by its great fertility and power of retaining moisture. The true *bhat* is a narrow strip along the river, but the strip widens to the east, and tappas Patharhat, Bhir, Bisonganw and Chatsi are *bhat* throughout. Away from the river this soil begins to need irrigation.

Practically the whole tract can be irrigated in ordinary years from the large *tals* and from wells. Water is only 10 to 15 feet down, and very cheap masonry wells are usually made. In serious drought, however, the *tals* fail, and the rabi area is restricted.

The tract is adequately drained, but the depressions may suffer from exceptional floods. Flood water from the Rapti occasionally passes into the channel of the Ami.

Basti.

The tappas which lie wholly or mainly in this tract are shown below :—

Pargana Amorha.

Tappas.

Bangawan (north).
Purena (north).

Pargana Nagar (west).

Tappas.

Khuriar.
Ganeshpur.

Pargana Basti (west).

Tappas.

Atroh.
Ratanpur.
Shiupur.
Hardi.

Pargana Basti (east).

Tappas.

Kothila.
Umra.
Sikandarpur.
Pandia.
Kandar.
Haveli.
Deoraon.

Pargana Maghar (west).

Tappas.

Rudhauli.
Banskhor.
Gusiari.

Pargana Mahuli (west.)

Tappas.

Kapri Mahson.
Bargaon Pagar.
Koraon.
Dihi.
Mathauli.

Pargana Maghar (east).

Tappas.

Majhaura.
Sakra.
Gopalpur.
Belhar.
Ujiar.
Baknchi.
Phulethu.
Amanabad.
Dewapar.
Churaib.
Utrawal.
Menhdawal (west).
Bakhira.
Un.
Rampur Paili.
South Haveli.
Maghar.

Pargana Mahuli (east).

Tappas.

Karri.
Auradand.
Tama.
Mandar.
Fidaipur.
Karsand.
Bankat.
Muhabra.
Deokali.

Pargana Rasulpur.

Tappas.

Sehri.
Bhanpur.
Adampur.
Hallaur.
Sagra.
Chhapia.

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Pargana Bansi (east).
Tappas.
Masna. Asnar. Khesarha. Kudaran. Gullaur. Patna Hasanpur. Chatsi. Bisongaon. Bhir. Patharhat.

The Burhi Rapti kachhar.—This tract lies along the course of the Burhi Rapti (not the present course of the river) in parganas Bansi west, Bansi east, Maghar west and Maghar east. The soil consists mainly of *bhat*, but often of inferior quality and shading off to sand.

Irrigation is little needed except where the *bhat* lies low and is stiff: water is available where required.

The greater part of the tract is flooded every year, and it depends mainly on the rabi.

The tappas lying wholly or mainly in this tract are shown below :—

Pargana Maghar (east).	Pargana Bansi (east).	Pargana Bansi (west).
Tappa.	Tappas.	Tappas.
Menhdawal (east).	Hata. Chaur (east). Kondri (east). Dabra.	Barikpar (east). Khajahni (south). Dhebarua (south). Khankot, Kop and Budhi } narrow strip on north.

The north-west tract.—This includes the country between the Rapti and the Burhi Rapti west and north of the town of Bansi. It is not homogeneous, the soil varying from heavy clay fit only for rice to lightish loam. The principal late-rice areas are (1) tappas Awainian, Budhi, Kop, Khankot and

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Dewaichpar, which, away from the boundary rivers, are almost entirely clay: (2) parts of tappas Hir, Karhi and Kot, where however there is a larger proportion of light soil, and more rabi is grown. Tappas Kot and Kaira are inferior, having much poor undulating soil. The south of tappa Barikpar, with Pachahr and a few villages in neighbouring tappas are like the *uparhar* tract and give good rabi crops.

Irrigation is mainly from *tals*, and is not much needed in ordinary years.

Parts of Awainian and Budhi are liable to floods from the overflow of the Rapti, which causes serious injury to the late rice areas.

The tappas which lie wholly or mainly in this tract are shown below :—

Pargana Bansi (west).	Pargana Bansi (east).
Tappas.	Tappas.
Awainia.	Pachahr.
Budhi (most).	Kondri (west).
Kop (most).	Chaur (west).
Khankot (most).	
Hir.	
Dewaichpar.	
Kot.	
Barikpar (west).	
Khaira.	
Khuniaon.	
Karhi.	

The north-east tract.—This includes the country north-east of the Burhi Rapti. The two tappas Dhebarua and Khajahni on the west are mainly rice land of the *tarai* type, but they yield good late rice, which however is liable to injury from sudden changes in the course of the various hill torrents. The rest of the tract is still rice-country on the whole, but rabi is much more general and towards the south a heavy loam is the commonest soil. The principal late-rice tappas are

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Barhou, Banjaraha, Birdpur and Bhatinpar: and rice is also important in Sirwant, Aikhin, Bargudwa and Netwar.

The late rice in tappa Birdpur has been protected by a system of private canals, and is practically secure against ordinary droughts, but the supply of water falls short in seasons such as 1896; similar works protect part of Banjaraha.

Floods cause some injury in parts of tappas Banjaraha, Barhon, Sirwant and Aikhin, but the area affected is not very great. Tappa Suhila suffers severely, and there rabi sowings are sometimes prevented. The rest of the tract suffers only in exceptional years.

The tappas which lie wholly or mainly in this tract are shown below:—

Pargana Bansi (west).	Pargana Bansi (east).	Pargana Binaikpur.
Tappas.	Tappas.	Tappas.
Dhebarua (north). Khajahni (north).	Banjaraha. Barhon. Aikhin. Sirwant. Nandepar. Tharauli. Birdpur. Bargadwa. Gharwaspur. Sohas. Suhila, Untapar, Nagwa and Naksauli.	Netwar. Bhatinpar.

Water-supply.

The chief sources in the various tracts have been mentioned above. Temporary wells can be readily made practically everywhere except on the edge of the upland, but they are comparatively little used in the north of the district. There are very large numbers of cheap masonry wells, usually of bricks set in mud: the great majority of these apparently are supplied by percolation and not carried down to a spring. Local information regarding the position of the foundation-clay is vague and untrustworthy as it is not the practice to look for it: so far as is known the distribution is irregular. The cheap percolation wells are effective and popular with cultivators but at the time of well-survey hostility on the part of landholders was recorded in a few villages in almost all parganas. Apart from these cases there were at the time of the survey over 300 villages where capital was required to build more wells.

Cattle-supply.

The stock of cows in the district is large and the supply of bulls adequate. There are no large breeding herds, and the stock suffer from the fact that most of the milk is used for *ghi*-making. Grazing grounds within the district are limited, but cattle are taken in large numbers across the Nepal border for part of the winter and the hot weather.

Working animals of superior type are imported from Bahraich and the submontane districts further west.

The district is liable to all the common forms of cattle-disease, but serious outbreaks of rinderpest have been few in recent years. There is as yet no demand on the part of the people for preventive inoculation.

Annals.

There is little information regarding disastrous seasons before the introduction of the system of annual reports. There was distress requiring special relief measures in 1874 as the result of drought in the previous year: while the drought of 1877 necessitated relief from February to October 1878. The first report was received in 1895. The rainfall of 1894 was excessive, and there were serious floods in the east of the Gogra lowland and in the Burhi Rapti *kachhar*. In 1895 floods did little damage, and though the rice suffered from drought, the crops were much better than was the case in most of the provinces. In 1896 rain lasted long enough for the early crops to give some produce, but the late rice was almost

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a total failure, and even in the canal-protected parts of Birdpur this crop yielded only six annas. The rabi area of 1897 was restricted in all tracts, but the falling off was greatest in those parganas which include the edge of the upland.

There was distress during these seasons, which was acute in part of Domariaganj and most of Khalilabad, and regular relief works were necessary, but the rabi yield was good, and the district recovered rapidly with the favourable monsoon of 1897. In the following years up to 1902 no serious calamity was reported; there were ordinary floods, and a few villages on the Gonda border suffered from wild cattle, deer and pig coming from the government forest; in 1901 the condition of these villages was improving. In 1902 the tracts liable to flood were noticed to be prospering owing to the succession of dry seasons.

The seasonal yields since 1903 are given in the following table :—

Year.	Rabi.						Kharif.			
	All crops.	Wheat.	Barley.	Gram.	Peas.	Linseed.	All crops.	Rice.	Maize.	Sugar cane.
1903 ..	100	100	94	94	94	100	86	87	75	100
1904 ...	94	87	100	87	87	75	87	87	75	87
1905 ...	77	81	87	81	75	69	85	83	50	94
1906 ...	81	81	87	94	69	87	61	60	Not available.	87
1907 ...	68	62	69	75	69	81	37	25	80	55
1908 ...	84	100	100	62	62	62	71	56	100	50
1909 ...	78	87	81	56	75	62	100	100	100	62
1910 ...	100	100	100	100	113	75	89	90	80	100
1911 ...	91	81	94	100	100	94	...	...	...	...

The rains of 1903 were late, and the kharif area was reduced owing to the impossibility of transplanting rice: the falls were however heavy and there were floods on the rivers,

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while the prolongation of the rains into October secured much the largest rabi area on record for 1904.

The rains of this year were too heavy for the early kharif, while September was too dry for late rice ; this crop however benefited by good rain in October, and the rabi area of 1905 was very large though below that of the previous year. The exceptional frosts of February did comparatively little harm : linseed was injured by rust, and rapeseed by the aphis. The rains of 1905 were irregular : they began nearly a month late, and were practically continuous throughout August, but badly distributed and inadequate in September. There were floods on the rivers, and maize was much injured by excessive rain. The rabi area of 1906 fell off, and the season was not very favourable as the rain fell too late and strong winds prevailed.

The rains of 1906 were marked by prolonged wet weather in July and August, and inadequate falls in the latter part of the season. Severe floods occurred on the rivers before the early kharif could be saved : the early kharif was much damaged by the rain while the late rice was very poor and failed over extensive areas. The following rabi suffered from late rain in February and March, and wheat in particular was affected by rust. The rains of 1907 were late and ceased early ; fair early crops were obtained but the rice was bad, and the late rice was in most places lost. The rabi area of 1908 was greatly restricted, and while the cereals did well pulses and oilseeds were poor. The larger part of the district escaped distress during the seasons, but in the north-west (Domariaganj and the north of Harraiya) measures of relief were necessary from January to August.

The rains of 1908 were satisfactory at first but very insufficient at the end of the season. Sugarcane suffered from drought and also from the cane-hopper (which had not been reported before from this district) : and the late rice was

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particularly bad in Domariaganj. The rabi area of 1909 was again very low, and the crop suffered from drought in the early stages of growth. Relief measures had to be resumed in Domariaganj and continued until July. The following rains began exceptionally early and were satisfactory throughout: sugarcane was however severely injured by the cane-hopper, and there were floods on the rivers. The rabi area of 1910 was almost normal and the yield excellent; while the following monsoon was on the whole satisfactory though considerable loss was caused by floods in the lowlands. Heavy rain in October secured a very large rabi area for 1911: and the yield would have been exceptionally good but for cloud and damp late in the season which affected wheat in particular.

Progress.

The extension of cropping during the last decades has been very slight, and there is little room for further expansion. The proportion of the area devoted to high-class crops on the whole shows no change in this period. Wheat and oil-seeds are well maintained, but sugarcane has of late tended to decline. The area under poppy expanded but has now been reduced. On a small scale, potatoes are becoming of some importance.

The construction of masonry wells has proceeded very rapidly of late years, close on Rs. 7,000 having been brought into use between 1906 and 1911. No other improvements in irrigation have been carried out.

The population of the district rose between 1891 and 1901, but there has been a slight decline in the last decade: in 1911 it stood at 1,830,000 as against 1,786,000 in 1891.

Agricultural wages have risen slightly in the last five years, and rates above two annas have become established in some localities; the common rates recorded in 1911 ranged from 1½ to 2¼ annas.

Advances for land improvement were trifling in amount until 1907-8 when three lakhs were given for masonry wells. Since then advances have been taken on a scale that is relatively considerable. Before the famine small sums were regularly advanced for temporary needs, but between 1907 and 1909 the advances aggregated 8½ lakhs, and large sums have been taken in the last two years. Agricultural co-operation has made a satisfactory start: in 1911 there were 61 rural credit societies with 900 members, financed by the district bank.

The railway system has been extended by the line through the north of the district, which has already led to a development of trade: in 1911 there was one station to 216 square miles as against 395 square miles in 1891. Communications by road have also been substantially improved but they are still very backward, and traffic is hampered by the want of a large number of bridges.

No conclusion can be drawn from the figures as regards the movement in rents. The recorded rents gave rates that showed no change from 1894 to 1903, but the records did not show the facts. Attempts to improve them resulted in a sudden apparent rise between 1904 and 1906, but it is not to be expected that the facts have yet been completely ascertained.

There is practically no industry of importance apart from weaving, which here as elsewhere has suffered from competition, while the income from external sources is less than in the rest of the division. Sums distributed by money-order average about 12½ lakhs annually as compared with about eight lakhs at the end of the last century.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage

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and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be curtailed but early rice will extend.

The area under late rice, which is about one-fourth of the whole, depends mainly on the second month of the season: frequent falls of rain with little sunshine are required, and a long break at this period may reduce the area substantially.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

2. The yield of the early dry crops, of which maize and *kodon* are most important, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late rice requires moderately heavy rain in September, and at least one fall in October is desirable for its complete success. The late dry crops are of practically no importance.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

The proportion of rice to other early crops is high, but too high for the weather that is ordinarily expected; and

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if the rains last long enough for the early rice to mature, their subsequent failure is important only for the late rice and for rabi sowings.

3. Apart from variations in the rainfall, the most serious damage to the kharif comes from floods in the lowlands. The loss is not usually great along the Rapti and Burhi Rapti, but it may be very serious in the eastern part of the Gogra tract if the floods come before maize, the chief staple, is harvested.

Sugarcane is liable to serious injury from the cane-hopper (vide Provincial Note, section VI). Serious loss by other insect-pests has not been reported, but should be watched for.

4. The rabi area depends on the rainfall at the end of the season. It may rise considerably above the normal if good rain falls in October, while a serious fall must be expected if the rains cease at the beginning of September. The area in the lowland-tracts may be reduced if the floods last so long as to leave the land unfit for sowing.

5. Winter rains are highly beneficial up to about the middle of January provided the falls are moderate and of short duration: falls in February and March will probably cause some injury, while prolonged periods of damp and cloudy weather in January and February must be expected to produce rust on wheat and linseed. The injury from this cause may be very great, and its extent may not be fully realised till the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

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6. Frost occurring early in February does little damage: it is probable that late frosts may cause very serious loss, but this has not occurred in recent years; the exceptional frosts of the first few days of February 1905 did little harm in this district.

Hailstorms early in the season are of little importance, but the danger increases as the season advances.

The rapeseed crop may be injured severely by the aphis if damp and cloudy weather occurs while the plants are in flower.

The poppy crop is liable to serious injury if damp and cloudy weather occurs late in the season.

7. The area sown with *zaid* crops in ordinary years is not large, nor does it extend greatly in unfavourable seasons.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of percolation-wells decreases, while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will probably be most noticeable in the lowland tracts.

9. Distress requiring some measures of relief must be expected to occur if the rains have ceased by the beginning of September. In the past the distress has been most marked in the Domariaganj tahsil. The following measures were taken in 1907-8 :—

Revenue suspended, kharif	Rs. 61,000
,, ,, rabi	,, 14,000
,, remitted: kharif	,, 68,000
,, ,, rabi	,, 45,000
Improvement loans	,, 3 lakhs.
Advances for rabi...	,, 3½ ,,
,, ,, kharif	,, 4½ ,,

Maximum proportion of population relieved 2 per cent. in May.

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Basti.

10. There has been no experience of conditions producing such a shortage of fodder as to render government action necessary, and the contingency appears to be very remote.

11. The only measures that can be suggested for the improvement of the water-supply are (*a*) the continued grant of loans for the construction of masonry wells, and (*b*) possibly provision for embankments in some of the rice tracts (vide Provincial Note, section III).

12. There is at present no demand for drainage works: the loss by flooding in the lowlands is serious but no practicable remedy can be suggested.

The bed of the Rapti is gradually silting up, and there is a possibility of its shifting its course at some period in the future. A change would produce a calamity of such magnitude that it is desirable that the position should be examined by an expert in order to determine whether there is any danger in the near future.

13 In order to minimise loss from cattle disease, it is desirable to enforce strictly the system of reporting outbreaks prescribed in the Land Records Manual, and to maintain a veterinary staff sufficient to localise outbreaks when they occur. Efforts should also be made to educate the people, through their leaders, in the advantages of protective inoculation.

14. The district is not well supplied with agricultural capital. The supply will probably be increased gradually by the extension of the co-operative organisation, but for the present there is considerable scope for the *takavi*-system. Improvement loans may be wanted for masonry wells, and possibly for embankments in the rice country. Agricultural loans are likely to be required in the following circumstances—

(*a*) *Early cessation of the rains.*—Large sums will be wanted for the rabi and again for the following kharif, while there may be a demand about February for sowing sugarcane and *zaid* crops.

(*b*) *Floods.*—Advances may be required to enable the rabi to be sown.

(*c*) *Cattle disease.*—It is important that cultivators should be able to replace their working-stock before the beginning of the next tillage-season.

(*d*) *Curtailment of the poppy area.*—Advances may be desirable in villages where the crop has been largely grown to enable cultivators to substitute some other remunerative crop.

15. There does not seem to be any possible agency other than the co-operative organisation for introducing agricultural improvements requiring associated action. The crops of the district require to be examined before suggestions are made for their improvement, but probably there is room for new varieties especially of wheat and sugarcane. There is not likely to be a large demand at present for expensive agricultural machinery, but the cheaper forms of improved implements should gradually come into favour, especially in the lowland tracts. Parts of the district appear to offer advantages for the establishment of a modern sugar-industry.

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DISTRICT NOTE.

AZAMGARH.

COMPLETE agricultural statistics are not available for this district between the year 1897-8 and 1906-7, which were occupied by survey and settlement proceedings. The statistics for years previous to this interval cannot be compared directly for the district with those compiled after its close owing to the transfer of some villages from Gorakhpur which was effected in 1904. The former and present figures are comparable for all parganas except Muhammadabad, Sagri, Gopalpur and Ghosi.

Topography.

The district is divided into three main tracts, the southern (termed *khalar*), the central (*bangar*) and the river (*kachhar*).

The southern tract comprises the whole of tahsil Deogaon, parganas Kiriat Mittu and Chiriya Kot in Muhammadabad, and the south of parganas Mahul and Nizamabad. The soil is mostly clay: lakes and marshes abound and there are extensive *usar* plains. This tract is drained by several streams flowing generally south-eastwards: at first their beds are shallow, and they can be dammed for irrigation; but towards the east the beds get deeper, and lighter soil is found in their neighbourhood. The distinctive feature of the tract is that about half the cultivated area yields only late rice, which requires rain up to October for success.

The central tract includes parganas Atraulia and Kauria, the north of Mahul and Nizamabad, the south of tahsils Sagri and Ghosi, and the greater portion of parganas Muhammadabad and Mau. The soil is usually a good firm loam, with

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lighter land near the rivers and clay in the depressions. The tract is adequately drained by the Tons and its affluents; the Tons however has a narrow bed, and in seasons of heavy rainfall it comes down in high flood, threatening considerable loss of property but affecting only a small area of cultivation. The proportion of land sown with late rice does not exceed one quarter.

The *kachhar* consists of a tract of varying width along the north of the Sagri and Ghosi parganas, together with the abandoned bed of the Ghagra, known as the Chhoti Sarju, which runs south-eastward between these tahsils and then between Ghosi and Muhammadabad. The width of the *kachhar* along the Ghagra is greatest in tahsil Sagri: in Ghosi it almost disappears at Dohri ghat, but it becomes extensive again in pargana Nathupur. The land close to the Ghagra is not of high value, consisting of sand with a deposit of soil of depth varying with the depression: the kharif is liable to floods, and the rabi may suffer from excessive moisture as well as from deposit of sand. Away from the river and along the Chhoti Sarju there is less danger from floods and sterile deposits, but the rabi does poorly in wet years, and the land tends to go out of cultivation owing to the discouragement of cultivators rather than any permanent deterioration.

Water-supply.

A very large area is irrigated in the southern tract from *jhils* and from the minor rivers. The supply cannot be made sufficient for the late rice in dry seasons, and there appears to be increasing difficulty in securing united action for the construction of the necessary dams. The rabi depends mainly on wells. Temporary percolation wells are not very popular and are inefficient in dry seasons, but cheap masonry wells exist in very large numbers, and their construction is proceeding rapidly. Foundation-clay is met with almost everywhere, except one tappa of Mahul and two of Nizamabad, and no hostility has been recorded: the completion of the equipment of the tract is a question of capital. The district officer in reviewing the results of the well-survey considered that more wells are needed throughout the tract: the need is greatest in pargana Deogaon and least in Kiriat Mittu.

In the *bangar*, temporary wells are used to a considerable extent in the east, but are not popular in the bulk of the tract, where the number of cheap masonry wells is very large. Foundation-clay is in some cases reported to be absent, but probaby exists at too low a level to be reached without boring. The Collector considers that more wells are needed throughout, and that the supply of capital is the most important point. Disunion in the large proprietary bodies was reported to be a serious obstacle to construction, but it was hoped that the offer of capital would produce harmony.

In the *kachhar*, irrigation is not required close to the river: in the more stable portions it is adequately supplied from the rivers and lakes and from temporary wells.

Cattle-supply.

The stock of cows is small in the *bangar* and the southern tract: they are kept for milk, and the young stock raised is inferior. In the *kachhar* along the Ghagra the stock is relatively large, but here milk and *ghi* are the chief objects, and the young stock is of poor quality. The supply of bulls set apart for breeding appears to be sufficient.

The district imports large numbers of working cattle: they are brought by dealers from Bahraich, Gonda and Basti, and from the Dadri fair in Ballia. It is noticeable that many cultivators in the southern tract do not keep a pair of bullocks, though each has a plough: in some cases a cultivator keeps a single bullock and clubs with another in the same position to make a pair; in others he works for another cultivator in return for the loan of his bullocks.

There has not been much rinderpest of late years, though severe outbreaks are known to have occurred in the past:

other forms of cattle disease are common. The people are still very suspicious of the practice of inoculation.

Annals.

The early annals of the district contain few outstanding features: the event most clearly remembered is probably the great frost of 1819. The droughts of the nineteenth century were as a rule little felt but in 1878 the provision of some relief was found to be necessary. In 1890 there was an exceptional flood on the Ghagra, and the succeeding seasons being wet cultivation decreased in the *kachhar*.

The first regular report was received in 1895. The district was then suffering from the recent wet seasons and from congestion of the population. The monsoon of this year was light and ceased early: the kharif was poor and the rabi area of 1896 was reduced. The following rains ceased in August: the late rice was lost, and the early rice yielded very little while the rabi area of 1897 fell further. The southern tract suffered most because of the small rabi area, and the existence of distress was recognised in tahsils Deogaon, Azamgarh and Muhammadabad. The demand for relief slackened when the rabi was gathered, but a certain amount was required until the following August.

The rains of 1897 were favourable, but there were floods on the Ghagra: in 1898 late rice suffered slightly for want of rain in October, while loss was caused by erosion of good land along the Ghagra. The rains of 1899 were at first abnormally heavy, but later they were deficient, and all crops suffered from one cause or the other. There was also some damage from insects, while the rabi of 1900 was seriously affected by rust.

The rains of 1900 though generally favourable were unsuited to the late rice crop, as there was a prolonged break that either prevented transplantation or injured the newly-planted fields; the rabi of 1901 again suffered from rust brought on by prolonged damp and cloudy weather. The following rains were deficient; transplantation of rice was prevented in places, and late rice and sugarcane yielded poorly. Erosion continued on the Gogra. The rabi of 1902 yielded fairly well; the following monsoon was late and at first deficient, but subsequently favourable; sugarcane was found to have suffered severely from boring-insects.

The seasonal yields since 1903 are given in the following table; the system of estimating yields is not yet satisfactory in this district, and the figures given, though comparable among themselves, are substantially understated :—

Rabi.			Kharif.		
Year.	Barley.	Peas.	Rice.	Small milletts.	Sugarcane.
1903 ...	115	75	69	56	75
1904 ...	87	87	71	69	75
1905 ...	75	50	84	81	87
1906 ...	81	81	57	87	87
1907 ...	75	75	20	75	50
1908 ...	100	75	50	75	75
1909 ...	81	75	78	94	81
1910 ...	94	94	90	84	87
1911 ...	87	94	...	...	...

The rains of 1903 began very late, and were at first light but afterwards heavy. There was a high flood on the Tons, but it caused little damage. Locusts appeared in July but did not settle. In 1904 the rains were heavy at first, but weak in September. The following rabi was injured first by damp, which brought on rust, and then by the exceptional frosts of February. The frosts injured peas severely almost everywhere; other crops for the most part escaped except in well-defined tracts where they suffered greatly. The damage was greatest on the west of the district, and along the course of the Tons. The report for this year noticed that though no figures were available, cultivation was certainly recovering in the

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kachhar and in a group of rice-growing villages in Muhammadabad which had suffered specially during and after the famine.

The rains of 1905 were on the whole favourable; but in this year the damage caused to sugarcane by the cane-hopper began to attract attention in tahsil Azamgarh. The rabi of 1906 was fairly good, but the rains were unsatisfactory: at first they were heavy, and there were floods in the *kachhar*; but the falls in September were light and the late rice was very poor. The rabi of 1907 suffered from rust brought on by cloudy weather in January and February. The rains ceased at the beginning of September, and all crops suffered, late rice being almost an entire failure. The cane-hopper was spreading and causing increased injury during this season. The people managed to sow a remarkably large area for the rabi of 1908: peas yielded only moderately, but the other crops were good. During these seasons the southern tract suffered most, but distress was at no time serious. Aided works were open, and a small amount of gratuitous relief was continued up to August.

The rains of 1908 were late in starting, and they were deficient in September, especially in the south where much late rice was lost. The cane-hopper continued to spread. With great exertions a normal rabi area was sown for 1909: the winter rains were scanty and water for irrigation was very scarce in the southern tract. The monsoon of this year was at first heavy, but once again the late rice suffered at the end of the season. The floods in the *kachhar* were not serious; but the cane-hopper continued to extend. The winter rains of 1910 were satisfactory and the crops good; and the following monsoon, at first defective, lasted long enough to give a satisfactory crop of rice and to secure a very large rabi area for 1911. In this year there was less complaint of the cane-hopper than for several years past.

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Azamgarh.

Progress.

The district has for long been very closely cultivated, and there has been no expansion in the last two decades. The *kachhar* tract has however recovered the area abandoned between 1890 and 1894. The class of crops is relatively poor and shows a marked deterioration in the same period. This is mainly due to the abandonment of indigo, which occupied about 30,000 acres; and sugarcane also shows a marked decline, though a tendency to partial recovery appears now to be at work. Wheat has extended somewhat, having replaced sugarcane, and hemp has become of some little importance. Among the food crops maize has extended considerably.

The great advance in regard to irrigation has been the increase in the number of masonry wells. Accurate statistics are not available for comparison, but it is known that, while the number increased steadily during the currency of last settlement, a marked impulse to construction was given by the dry seasons in the last decade. In 1911 the number of these wells was 33,330, giving 1 to 25 acres of normal cultivation.

The population of the district decreased largely between 1891 and 1901 and there has been a slight further fall in the last decade; in 1911 it stood at 1,493,000 as against 1,729,000 in 1891.

Wages show no marked movement during the last five years, and are perhaps slightly lower on balance.

Loans for land-improvement were practically unknown in the district until 1907-8, when nearly three-fourths of a lakh was distributed for masonry wells. Apparently such loans are becoming popular, as in the three years that have elapsed an aggregate of close on half a lakh has been taken. Loans for temporary purposes are not taken in ordinary years, but they can be employed most usefully in adverse seasons, and between 1907 and 1909 over five lakhs were distributed. In 1911 there were only two rural credit societies in the district, but a development of the movement is anticipated.

There has been a very marked improvement in the system of communications. Twenty years ago railways were non-existent, though the Oudh and Rohilkhand line just touched the district on the extreme west. In the interval the Bengal and North-Western Railway has extended through the east, north and centre of the district, so that in 1911 there was one station to 138 square miles. The north-west is perhaps the only direction where railways are still required, but a project for a line in this direction has been abandoned.

The metalled-road system is extensive, and recent additions have consisted chiefly of small lengths to the railways; the metalling of the road to Fyzabad, which is in progress, will probably suffice to meet the needs of the north-west of the district. The great need of the district is for more bridges.

The movement of rents is very slow; the rate is kept down by the privileges accorded to high-caste tenants and by the large proportion of the area which is cultivated by landholders. Occupancy rents recorded during the settlement gave a rate of Rs. 5·3 per acre, and other rents worked out to exactly the same rate. It is possible that these may be rising, but the period since settlement is too short for any conclusion to be drawn.

There has been no development of industry on a large scale, and the indigenous industries have on the whole declined seriously. The abandonment of indigo has withdrawn seasonal employment from about 7,000 or 8,000 hands: sugar-refining has diminished appreciably; and weaving is much less important than it used to be, though it has somewhat revived in Mau since the opening of the railway. Saltpetre extraction is understood to be prosperous.

The district draws a large and increasing income from external sources, the people of both high and low castes being accustomed to seek employment in Calcutta, Bombay and

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elsewhere. At present the post office distributes about 31 lakhs of rupees annually in money-orders as against 16 or 17 lakhs at the end of the nineteenth century.

Dangers, and possible remedies or improvements.

1. The area sown with kharif crops other than late rice and sugarcane depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowings to proceed without interruption. If the first month is wet, sowings of dry crops will be reduced while early rice may extend.

The area under late rice, which is the principal crop in the southern tract and is also important in the centre, depends on the second month: frequent falls of rain with little sunshine are required, and a long break at this period may reduce the area considerably; no other crop can be substituted in these conditions.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

2. The yield of the dry crops, of which sawan and maize are the most important, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late rice requires moderately heavy rain in September and at least one fall in October is desirable for its complete

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success. Late dry crops are not grown on an appreciable scale.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain but prolonged breaks are likely to cause injury.

The early crops are fairly well balanced between rice and dry crops, and the central tract should not be seriously distressed if the rains last long enough to secure the early rice. The southern tract however depends so largely on late rice that an early cessation of the rains involves serious loss.

3. Apart from variations in the rainfall, the chief danger to the kharif crops arises from floods in the *kachhar*. The extent of loss depends on the period at which they occur, that is on the amount of kharif that has been safely harvested.

The floods of the Tons are of less importance as the area affected by them is small.

Sugarcane may suffer both from borers and from the cane-hoppers (vide Provincial Note, section VI).

4. The rabi area depends mainly on the amount of rain received in September and early October. Heavy rain in October leads to a large extension, while an early cessation of the rains involves a reduction, which however can be mitigated by the grant of advances.

The area in the *kachhar* is affected by the Gogra floods; a late flood occasionally leaves the lower land too wet to be sown, or covered with sterile deposit of sand.

5. When the ground has been sufficiently moist at seed-time, the rabi yield depends relatively little on winter rains as the bulk of the crops can be matured with irrigation. Falls are however beneficial up to about the middle of January, provided they are moderate in amount and of short duration.

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Later falls will probably cause some injury, while prolonged periods of damp and cloudy weather must be expected to produce rust on wheat and linseed, and possibly also on barley. The loss from rust may be very serious, and its extent may not be fully realised till the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such season must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring early in January does little harm. A late frost may however cause very serious injury: probably the third or fourth week in January is the most dangerous period.

Hailstorms early in the season are not important, but the danger increases as the season advances.

The rapeseed crop is liable to serious injury from the aphis, if damp and cloudy weather occurs while the plants are in flower.

The poppy crop may suffer severely from damp and cloudy weather late in the season.

7. The area sown with *zaid* crops in ordinary seasons is small and apparently it does not extend largely when stocks of food are low.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells

useless in some tracts, but this occurrence has not been reported.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the *kachhar;* there the loss of fertility may become so great that the land goes temporarily out of cultivation, and any decline in cultivation in this tract should be watched very carefully.

9. Distress requiring some measures of relief must be expected to occur after a premature cessation of the rains. The central tract should escape if the rains last long enough to mature the early rice, that is ordinarily into the first week of September, but the southern tract requires rain until nearly the end of that month. In 1907-8 distress was practically limited to this tract, and was slight: the following measures were taken :—

Revenue suspended, kharif	3 lakhs.
" remitted kharif	1 lakh.
Improvement loans	⅜ lakh.
Advances for rabi	3 lakhs.
" " kharif	1 lakh.

Maximum proportion of population relieved 0·5 per cent. in February.

10. Experience does not indicate the conditions under which so great a deficiency of fodder may occur as to require intervention by Government. The late millets are so little grown that even their entire failure would make little difference.

11. As has been indicated in the section on water-supply, the great need of the district is for loans to make more masonry wells. A boring staff should also be maintained to locate sites in doubtful localities, and to pierce the foundation-clay where it is too thick for country tools.

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The question of embankments in rice-land is of special importance in the southern tract (vide Provincial Note, section III).

12. There is no demand for drainage works at the present time; the natural drainage of the southern tract is not perfect, but the presence of water at the end of the season is so essential for the late rice that drains are not likely to be accepted by the people.

The channel of the Tons will naturally receive special attention in any investigation into the drainage of the Ganges-Gogra doab, in order to see if anything can be done to mitigate the periodical floods.

13. In order to mitigate losses from cattle disease, it is important to enforce strictly the system of reporting outbreaks laid down in the Land Records Manual, and to maintain a sufficient veterinary staff to localise outbreaks when they occur. Efforts are also desirable to popularise through the leaders of the people the practice of preventive inoculation.

14. The district is exceedingly poor in agricultural capital: the defect may be met gradually by the extension of the co-operative organisation, but for the present at least there is a wide scope for the *takavi*-system. Improvement loans are wanted specially for masonry wells, and may also be required for embankments in the rice tracts. Agricultural loans may be required in the following circumstances:—

(*a*) *Early cessation of the rains.*—The demand for advances to sow the rabi is likely to be very large, and a further demand will arise for the kharif; while money may be wanted about February for sugarcane and possibly for *zaid* crops.

(*b*) *Floods.*—Advances may be needed in the *kachhar* when the kharif has been lost; and there may be a demand on the Tons if the floods have caused damage to homesteads or loss of cattle.

(c) *Cattle disease.*—It is important that cultivators should be able to replace working-cattle before the beginning of the next tillage-season.

(d) *Curtailment of the poppy area.*—Advances may be desirable in villages where the crop has been largely grown in order to enable cultivators to substitute some other remunerative crop.

15. There is at present no agency suitable for the introduction of agricultural improvements regarding associated action; the only possibility in this direction lies in the extension of the co-operative organisation. The cropping of the district requires examination before definite suggestions can be made for its improvement, but probably better varieties of sugarcane are needed at least in some localities. A new market-crop is also required to replace indigo, the loss of which has undoubtedly deteriorated the agriculture of the villages where it was grown: groundnuts appear to be the most suitable crop for this purpose. The demand for expensive machinery is likely to be small, but the cheaper forms of improved tillage-implements will probably become popular, especially in the *kachhar*.

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DISTRICT NOTE.

NAINI TAL.

Topography.

THE district consists of three well defined tracts, the hill-pattis, the *bhabar* and the *tarai;* of these complete agricultural statistics are prepared only for the *tarai*, but partial statistics for the *bhabar* are now available.

The hill-pattis include the parganas under the jurisdiction of the Naini Tal tahsil, and consist of ranges of steep hills separated by narrow valleys. Cultivation is practically limited to the level hill tops, the terraced slopes, and the alluvial land where the valleys widen out. About six per cent. of the measured area is irrigated by channels led from the streams; the chief crops are *mandua* and rice in the kharif and wheat and barley in the rabi, but potatoes are also important in some localities. The population is dense, but it is not entirely dependent on the land, as the people obtain a considerable income by supplying the needs of the European settlement at Naini Tal, while the *bhabar* is largely cultivated by tenants who migrate for the season from the hills.

The *bhabar* consists of a stony slope, covered by a thin layer of soil, which has been brought under cultivation to relieve the pressure on the hill pattis. Wells or tanks are impossible, and the rapidity of percolation makes irrigation indispensable to the growth of rabi crops. Cultivation depends on the canals supplied by the hill streams, and its extent is limited by the quantity of water available; the uncultivated land is mostly under forest. Rabi crops are more important than kharif, and most of the cultivation is done by tenants

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who come from the hills for the season. This tract now includes the Almora *bhabar*, which was transferred to Naini Tal in 1910. Some of the villages are settled with landholders, but the majority are managed by headmen (*padhans*) directly under Government, the headman receiving an allowance on the income of the village.

The *tarai* includes tahsil Kashipur as well as the Tarai tahsil. It consists for the most part of clay soil which is fairly fertile but there is much lighter soil towards the north which cannot bear continuous cropping. Irrigation is required both for the rabi, and for the important rice crop to meet deficiencies in the rainfall. Wells are practically not used for irrigation, but there is an extensive canal system supplied by the hill streams. The striking feature of this tract is the difficulty of keeping cultivators on the land, due to the unhealthiness and the unpleasant conditions of life. Fever is very prevalent, the drinking water is often bad, wild animals from the forests have to be reckoned with, markets are few, and social attractions scarcely exist. There is thus always land waiting for cultivators, and any aggravation of the ordinary discomforts sends the cultivators elsewhere, and the land vacated goes out of cultivation and soon returns to the jungle. The causes of the unhealthiness of this tract have not apparently been worked out in detail. The badness of the water has been traced to the fact that many of the wells draw their supply from a layer of soil heavily charged with organic matter, and efforts have been made, in many cases with success, to keep this water out of the wells and obtain a supply from a lower uncontaminated stratum.

The land in the south of Kashipur tahsil is intermediate in character between the *tarai* proper and the plains.

Cattle-supply.

The hill tract breeds its own cattle, while the *tarai* provides a substantial surplus for export, and affords a large amount

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of grazing to the cattle of the districts lying to the south. Rinderpest and foot-and-mouth disease occur very commonly in the district, and haemorrhagic septicaemia appears from time to time. The practice of inoculation is now welcomed by the people.

Annals.

Information regarding the district is somewhat meagre until recent years, and the absence of agricultural statistics for the hills, and till recently for the *bhabar*, make it impossible to give a detailed description. No part of the district is known to have required extensive famine relief in any season of drought, and no serious injury to the prosperity of the hill tract or the *bhabar* was reported until 1907. The western *tarai* however entered on a prolonged period of depression in about 1894. The cause was probably the series of wet seasons, leading to unusual sickness, but in Kashipur where the depression progressed most rapidly stress was laid at the time on the harshness of the landholders at a time when the tenants were impoverished. Though no measures of relief were required in the drought of 1896, this part of the district was further impoverished, while further losses followed the early cessation of the rains in 1899, and the decline in cultivation became more rapid. No amelioration was noticeable until 1906: in that year cultivation was very much below the standard of 1892—94 in Kashipur, Bazpur and Gadarpur, and to a less extent in Rudarpur, while in the eastern parganas (Kilpuri, Nanak Mata and Bilheri) the fall was slight. About this time the settlement of Kashipur was revised and large reductions in revenue took effect, while the rent rates of the *tarai* estates were revised. Cultivators then began to come in, and the fall in cultivation was checked. The early cessation of the rains of 1907 was severely felt in those parts of the *tarai* (chiefly the west of Kashipur), where canal irrigation is not available, and the rabi area of 1908 decreased largely: the *bhabar* was apparently little affected but parts of the hill-tract suffered. The depression was however temporary, and cultivation in the *tarai* is now substantially above the lowest level reached though still below the standard of 1892—94.

Progress.

In the *tarai* the class of crops shows a substantial improvement during the last two decades though the cultivated area has decreased; wheat is now much more largely sown, and cotton has expanded very rapidly in Kashipur since the opening of the railway. The staple of this crop is better than that usually grown in the provinces, and the crop is popular because wild animals leave it alone. Sugarcane has somewhat declined. In the *bhabar* also wheat has extended. In the hill pattis potato cultivation became very popular, but much of the land on which this crop was grown has now become exhausted. Tea has not extended, and several of the tea-gardens have been converted into orchards producing large quantities of fruit for the plains as well as the hills. The absence of statistics prevents a more detailed comparison.

In regard to irrigation the progress of the last twenty years has lain in the remodelling or improvement of a large part of the system of canals: the improvement does not appear in the statistics owing to the decline in cultivation.

Population fell heavily between 1891 and 1901 owing to the deterioration of the *tarai*; there has been a partial recovery in the last decade but the numbers are still below those of 1891. Agricultural wages have risen during the last five years, and in 1911 the rates exceeded four annas in the hills and *bhabar* and fell little below this figure in the *tarai*.

Advances for land-improvement are almost unknown in the district: sums aggregating Rs. 2,000 were taken in the famine year, but nothing since. Advances for temporary purposes are taken in small amounts in most years: the

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highest aggregate in any year is below Rs. 6,000. There has so far been no general attempt to introduce agricultural co-operation in the district, but a large credit society has been established among the Tharus of the eastern *tarai*, which in 1911 had 470 members.

The railway system has been greatly extended since 1907 by the opening of the lines from Ramnagar to Moradabad and from Kashipur to Lalkua: the central and western portions of the *tarai* are thus adequately served, while the eastern portion is traversed by the line just completed from Pilibhit to Tanakpur. The road system in the hills has been much improved during the past twenty years: the *bhabar* and *tarai* still depend on unmetalled roads with the exception of the road from Kathgodam to Bareilly.

The chief industry of the district is hand-loom weaving, which is still carried on extensively in the Kashipur tahsil, though it has suffered from competition. On the other hand Kashipur has become a centre of some importance for the trade in cotton, and two ginning and pressing mills have been erected there recently.

The district draws a relatively large income from external sources: payments of money-orders have varied between five and eight lakhs annually and show no tendency to increase in the past 15 years; a large proportion of this business affects only the European community. On the other hand the hill-station of Naini Tal brings a very large amount of money into the hills, and affords employment on what is relatively to the population a very large scale.

Dangers and possible remedies or improvements.

THE HILL TRACTS.

1. The sowing and harvesting seasons in the hills vary with the altitude to such an extent that it is not possible to indicate the conditions of success and failure with the same precision as in the plains.

Naini Tal.

In the lower hills the kharif depends on both the spring rains and the monsoon, and the rabi on the winter rains. Rain in March and April is of great importance for the sowing of the unirrigated rice crop, which takes place about April, and this crop requires occasional storms to keep it alive until the rains arrive. An early commencement of the regular rains is desirable, but their continuance to the latter part of September is of much greater importance; a cessation by the end of August leads to loss of a large proportion of the crops. Heavy rain does not appear to cause much direct injury to the crops, but its effects are serious when it causes landslips or destroys the terraced fields.

Landslips are frequently originated by unterraced cultivation on steep hill-sides, and such cultivation should be sternly discouraged.

3. The rabi requires several falls of rain during the winter: and it is important that the winter rains should continue at least into March in the lower valleys and into April in the higher.

There are very few records of injury from too much rain at this season; and no report of serious loss from rust on cereals has been received though the disease exists.

Serious injury from frost has not been reported.

4. Damage by ordinary insect-pests has not been reported in either season: but locusts enter the hills at long intervals and cause considerable injury where they settle.

Hailstorms in the spring may cause great local damage to cereals and also to garden-crops and orchards: they are of little importance in the winter.

5. So far as experience can be relied on, distress requiring measures of relief should not result from a single bad season, but it must be expected when the rabi crops fail after

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a bad kharif or vice versa. Conditions may vary greatly from valley to valley, and each valley must be dealt with on its merits.

When distress occurs, the most important measure is to ensure an adequate supply of food in the distressed areas, where even in good years the local produce is insufficient; the system of advances to merchants and of grain-credit orders introduced in 1908 will apparently serve this purpose effectively. Loans for subsistence, and gratuitous relief are also likely to be required: there is ordinarily comparatively little scope for relief works, but the opportunity should be taken of employing all surplus labour on improvements in communications.

6. There is no experience to show that a fodder famine is possible in any part of the hills; but with the increase of population and cattle there are indications of possible scarcity in the future unless the grass supply can be improved by conservation.

7. No measures can be suggested for the direct improvement of the water-supply; and the question of drainage does not arise. The water supply will however probably be improved considerably by the contemplated reservation of large forest areas.

8. There is sufficient pasture land for the cattle in most places, but it is not inexhaustible and difficulty is already being felt in places where cultivation is extensive. The reservation of forests will, it is hoped, improve the supply. The most important measure for the protection of cattle is the mitigation of disease, which is much more fatal than in the plains. The organisation of a system by which reports of outbreaks shall be promptly made, and the maintenance of a veterinary staff sufficient to prevent outbreaks from spreading are the essentials of the problem: but great difficulties arise from the obstacles to rapid travelling.

9. There is not much scope for the *takavi*-system in ordinary years. The chief agricultural improvement—the terracing of fields—must be carried out very gradually and cannot be done off-hand by the expenditure of capital; and improvement loans will probably be wanted only in exceptional cases for the construction or repair of water channels.

Agricultural loans may be required in times of scarcity as has been indicated above, and at other times to enable cultivators to replace cattle that have been lost by disease or accident: in ordinary seasons they are not likely to be required for other purposes.

10. There is probably not scope for large changes in methods of cultivation. The problem presented by the worn-out potato lands deserves further study than it has received. In the remoter villages the most hopeful line of agricultural improvement is probably the introduction of more valuable drugs and spices, the produce of which can bear the very heavy cost of transport. Within reach of markets, the promotion of market-gardening and orcharding is the most hopeful form of improvement.

11. It appears to be probable that the future development of the hills will be mainly on non-agricultural lines—extension of the tourist and pilgrim industry and of health resorts, manufactures based on forest produce, and possibly some utilisation of minerals. The first condition for any such developments is the improvement of communications: a programme of works has recently been drawn up for the district, but it should not be regarded as exhaustive. The question of labour will however affect developments such as are indicated: the people are prosperous, and do not need to work steadily nor are they inclined to do so.

THE BHABAR.

1. According to statistics the area is much less extensive than the rabi, but the *lahi* crop, which is classed under the

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latter head, is here sown as a late kharif. An early start of the rains is desirable, but it is much more important that the first month of the season should not be continuously wet: bright weather with just enough rain to keep the land fit for tillage is desirable.

2. The yield of the kharif depends mainly on the prolongation of the rains to the end of September. The crops may be seriously injured by either a prolonged break or by excessive and continuous rain.

3. The rabi area depends on the prolongation of the rains to the end of September, but in a moderately dry year the fall in area is not marked. The yield is almost independent of winter rains as the land is almost entirely protected by canals, and injury may be caused by falls late in the season. Prolonged periods of damp and cloudy weather may result in injury from rust to the wheat crop. Hailstorms may cause serious loss if they occur when the cereals have eared. The *lahi* crop may be seriously injured by the aphis if damp and cloudy weather occurs, while the plants are in flower.

4. Available supplies of canal water are fully utilized and the margin for extending cultivation is very small. In many villages at the tail of a canal cultivation is very precarious owing to the difficulty about water and the perpetual war with wild animals.

5. There is no record of conditions leading to distress in this tract, nor does a fodder famine appear to be possible. In the spring the cattle are taken either into the hills or to the north of the *tarai* where grazing and water are available.

6. No improvements in water-supply can be suggested beyond the policy already pursued of improving head-works and extending masonry channels. No drainage works are required.

7. The protection of the cattle from disease requires the organisation of a system by which outbreaks are promptly reported, and the maintenance of a sufficient veterinary staff to localise outbreaks when they occur.

8. The cultivators are expected to look to the *padhans* of the villages for the supply of necessary capital, so that the ordinary system of *takavi* is not required.

9. The system of cultivation requires to be examined before suggestions for its improvement can be offered.

THE TARAI AND KASHIPUR.

1. The area sown with kharif depends mainly on the weather during the first month of the season: rice being the staple crop this month should be fairly wet, but continuous rain is likely to reduce the area, and there should be bright weather with just enough rain to enable tillage operations to proceed without interruption.

The yield of rice depends on the prolongation of the rains till nearly the end of September: a long break or an early cessation of the rains will lead to substantial loss. Sugarcane requires much the same season as rice, but cotton, which is of growing importance in the west, requires much less rain, both in the sowing season and in September.

Serious damage to the kharif from insect-pests or other causes has not been reported, but should be watched for, particularly in the case of cotton which would be seriously threatened by the appearance of the bollworm (vide Provincial Note, section VI). Rice is believed to suffer seriously from some form of caterpillar, but the facts are not accurately known.

2. The rabi area depends mainly on the prolongation of the rains to the end of September or early October: a dry September leads to a very serious decrease. Winter rains are an advantage up to nearly the end of February, provided the

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falls are moderate and of short duration; rain at the end of the season is injurious, and prolonged periods of wet and cloudy weather must be expected to produce rust on wheat and linseed. The loss may be very serious, and its extent may not be fully realized till the crops are harvested.

3. There is no record of extensive damage by frost, and apparently there need be no anxiety unless frost occurs as late as the middle of February.

Hailstorms early in the season are unimportant. They may cause serious loss if the cereals have eared, and the danger increases as the season advances.

There is no record of serious injury to the rabi from insect-pests.

4. Experience does not indicate conditions in which the *tarai* may be so affected as to require large direct measures of relief, though suspension of revenue (or rent) and the offer of advances may be required when the rains cease early. In 1907-8 rents were remitted to a considerable amount, and some work was provided on the roads by the government estate. There is no indication that a fodder famine is a possible occurrence.

5. The chief risk to the prosperity of the *tarai* is a rise in water-level following on seasons of excessive rainfall. When this occurs the unhealthiness of the tract increases and the productivity of the land declines: holdings are abandoned, and the coarse grass that springs up harbours predatory animals: the process of deterioration once started is thus cumulative. The process cannot apparently be counteracted by direct measures, but its effects can be minimised by careful management, reducing the pressure of the rent (or revenue) providing capital when required, and also medical relief, and thus enabling the cultivators to remain on the land until seasons

improve. It is possible too that the risk of such a calamity is diminishing owing to the gradual deepening of the channels cut by the streams.

6. No measure can be suggested for the improvement of the supply of water for irrigation, and the effective drainage of the tract must be regarded as impracticable. The supply of water for domestic use is in many places naturally very bad, and a continuance of the present policy of providing good water by sinking wells with pipes to deep springs is desirable.

7. There is ample grazing for cattle and it appears desirable that the land should be devoted to this purpose rather than brought under cultivation. In the *tarai* a line has been drawn, north of which cultivation may not be extended to the detriment of grazing. The question may however have to be considered in Kashipur, which provides grazing for the herds of the Moradabad district, should the development of the cotton crop assume large proportions.

In order to minimize the losses from cattle disease, it is important to insist on the prompt reporting of outbreaks, and to maintain a veterinary staff sufficient to cope with outbreaks as they occur.

The improvement of the local breed of cattle is probably feasible, and the experiments in progress in this direction should not be hastily discontinued for want of obvious results at an early stage.

8. Those parts of the *tarai* which are managed directly by Government do not depend on the general *takavi*-system as the Superintendent provides capital for cultivators as required.

In the *zamindari* tract there is apparently little scope for improvement loans, but agricultural loans may be required to secure rabi-sowings when the rains have ceased early, or to replace working cattle that have died of disease.

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Naini Tal.

9. The agriculture of the tract requires to be examined before definite suggestions can be made for its improvement There is probably room for improved tillage implements, and even for more expensive machinery as wages are very high and labour is unprocurable at any price during certain seasons: and it is probable that better varieties of crops can in some cases be substituted. One question that might be studied is the possibility of reducing irrigation by adaptation of the methods of tillage so as to conserve more of the natural moisture.

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DISTRICT NOTE.

ALMORA.

Topography.

AGRICULTURAL statistics are not prepared for this district, and materials for its description are scanty. It may be divided roughly into two tracts, the lower hills, and the high mountains; formerly it included also a *bhabar* tract lying below the hills, but in 1910 this was transferred to Naini Tal.

The *lower hills* are thickly populated, and contain a considerable area of cultivation, which, however, is scattered in small blocks either on the more level hill-tops, in terraces on the slopes, or in the wider parts of the river valleys. Cultivation is most successful at elevations of from 3,000 to 5,000 feet; mandwa, jhangora and rice are grown in the kharif, and wheat and barley in the rabi. The land is irrigated when possible by channels from the streams and rivers, but most of the cultivated area is dry. The cultivators in the south of this tract are not entirely dependent on the land of their own villages, as they migrate regularly to the *bhabar* for the rabi season.

The *high mountains* may be said to stretch northward from a line drawn across the district from Kapkot to Askot. This tract consists mainly of glaciers and high mountain ridges. There is little cultivation at the greater elevations; the people depend mainly on trade, and a single crop, usually wheat, barley or *phapar*, is obtained between June and November. The tract is, however, pierced by the deep valleys of the larger rivers; in these the system of cropping resembles that of the lower hills.

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Cattle-supply.

The district provides its own cattle, and there is ample grazing land. Rinderpest and foot-and-mouth disease are common, and the former is exceedingly dangerous: other forms of contagious disease have not been reported recently. The practice of inoculation is now welcomed by the people.

Annals.

The district appears usually to receive sufficient rain in both seasons. When distress has occurred it has been the result of a failure of the winter rains following on a poor kharif: these conditions were realised in 1890 and again in 1892, when owing to the non-existence of any regular trade in food grains it became necessary for Government to undertake importation. In both years the western tract Pali-Pachaun was most affected. In 1894 some damage was caused by excessive rain, leading to landslips.

The district received sufficient rain in the famine year 1896. In 1899-1900 both harvests were inferior owing to scanty rainfall, and for a time there was some local scarcity of grain in the western pargana, Pali-Pachaun: this was relieved effectively by advances, and disappeared with the excellent crops of the following year. In 1901 some injury was caused to the kharif by locusts, and scanty winter rains led to an inferior rabi outturn in parts of Almora tahsil. Succeeding seasons were prosperous until 1905. This winter was exceptionally severe and the crops in the lower hills suffered, but more from excessive moisture than from cold. In 1907 again excessive rains caused slight injury to the rabi crops.

The monsoon of this season lasted only a month in the lower hills where the crops were very poor, but the higher tract received satisfactory falls in September. The rabi area of 1908 was contracted, and the failure of the rains in March and April resulted in a very poor yield in the lower hills: little relief was needed during the winter, but when the defects of

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the rabi crops became apparent it became necessary to provide works and give gratuitous relief. On this occasion Government imports of grain were avoided: advances were given to merchants to finance trade, while credit orders were given to individuals enabling them to obtain grain from dépôts at the foot of the hills. The credit orders were most successful during the hot weather, and the carriage of grain gave employment to large numbers of the people, so that the need for other measures of relief was small. The parganas most affected during these seasons were Pali-Pachaun, Bara Mandal and Chawgarkha.

The rains of 1908 were generally favourable but Pali-Pachaun again suffered from deficiency, and the rabi harvest of 1909 was reduced by drought in the spring. Stocks of food were low but relief was not required. Subsequent seasons up to 1911 were favourable.

Progress.

Statistics of the various crops are wanting. It is understood that potato-cultivation has been checked by the exhaustion of land on which this crop was grown, and by restrictions on its cultivation in positions where the denudation of the surface is likely to result in landslips. Tea has also not extended as the crop is not particularly profitable. There has been an increase in fruit and vegetable growing in the vicinity of markets.

The population has increased rapidly in each of the last two decades. The lower rates of rural wages are tending to disappear and the higher rates are spreading: the rates returned in 1911 varied from 2½ to 4 annas.

Loans for land improvement were practically unknown until the last famine when small sums were given, mainly for irrigation channels. The demand appears to have ceased. Advances for temporary purposes were given on a large scale in 1907-8: the grant of advances to grain-merchants in order to facilitate trade has already been mentioned, and it appears

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probable that the need for direct importation by Government will not recur. No attempt has been made as yet to introduce agricultural co-operation.

The trade of the west of the district has been considerably benefited by the extension of the railway to Ramnagar in Naini Tal, Ramnagar being the starting point of the system of cart roads. Similar advantages will accrue to the south-east of the district when the line to Tanakpur is completed. The road system has been considerably developed in recent years, but an extensive programme of work remains to be carried out.

The chief industry of the district is weaving woollen fabrics for local wear. An attempt is being made to develop this industry by means of weaving schools recently established at Almora. Organised industries are represented solely by the brewery at Ranikhet.

The south-west of the district derives a large income from the cantonments and health-resorts of Ranikhet and Almora, which provide considerable markets and employ large numbers of labourers. Other income derived from outside the district appears to be unimportant.

Dangers and possible remedies or improvements.

1. The sowing and harvesting seasons in the hills vary with the altitude to such an extent that it is not possible to indicate the conditions of success and failure with the same precision as in the plains.

2. At the higher altitudes, roughly above 7,000 feet, where only a single-crop season exists, the nature of the winter is unimportant; the crops depend on the rainfall of the monsoon. This is almost always sufficient or in excess, and excessive rain does considerable injury.

In the lower hills the kharif depends on both the spring rains and the monsoon, and the rabi on the winter rains. Rain in March and April is of great importance for the

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sowing of the unirrigated rice-crop, which takes place about April; and this crop requires occasional storms to keep it alive until the rains arrive. An early commencement of the regular rains is desirable, but their continuance to the latter part of September is of much greater importance; a cessation by the end of August leads to loss of a large proportion of the crops. Heavy rain does not appear to cause much direct injury to the crops, but its effects are serious when it causes landslips or destroys the terraced fields.

Landslips are frequently originated by unterraced cultivation on steep hill-sides, and such cultivation should be sternly discouraged.

3. The rabi requires several falls of rain during the winter: and it is important that the winter rains should continue at least into March in the lower villages and into April in the higher.

There are very few records of injury from too much rain at this season; and no report of serious loss from rust on cereals has been received though the disease exists.

Serious injury from frost has not been reported.

4. Damage by ordinary insect-pests has not been reported in either season: but locusts enter the hills at long intervals and cause considerable injury where they settle.

Hailstorms in the spring may cause great local damage to cereals and also to garden crops and orchards: they are of little importance in the winter.

5. So far as experience can be relied on, distress requiring measures of relief should not result from a single bad season, but it must be expected when the rabi crops fail after a bad kharif or vice versa. The danger is apparently greatest in Pali-Pachaun but conditions may vary greatly from valley to valley and each valley must be dealt with on its merits.

When distress occurs, the most important measure is to ensure an adequate supply of food in the distressed areas, where even in good years the local produce is insufficient;

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the system of advances to merchants and of grain-credit orders introduced in 1908 will apparently serve this purpose effectively. Loans for subsistence, and gratuitous relief, are also likely to be required: there is ordinarily comparatively little scope for relief-works, but the opportunity should be taken of employing all surplus labour on improvements in communications.

6. There is no experience to show that a fodder-famine is possible in any part of the hills; but with the increase of population and cattle there are indications of possible scarcity in the future unless the grass supply can be improved by conservation.

7. No measures can be suggested for the direct improvement of the water-supply; and the question of drainage does not arise. The water-supply will however probably be improved considerably by the contemplated reservation of large forest areas.

8. There is sufficient pasture land for the cattle in most places, but it is not inexhaustible and difficulty is already being felt in places where cultivation is extensive. The reservation of forests will, it is hoped, improve the supply. The most important measure for the protection of cattle is the mitigation of the disease, which is much more fatal than in the plains. The organisation of a system by which reports of outbreaks shall be promptly made, and the maintenance of a veterinary staff sufficient to prevent outbreaks from spreading are the essentials of the problem: but great difficulties arise from the obstacles to rapid travelling.

9. There is not much scope for the *takavi*-system in ordinary years. The chief agricultural improvement—the terracing of fields—must be carried out very gradually and cannot be done off-hand by the expenditure of capital; and improvement loans will probably be wanted only in exceptional cases for the construction or repair of water channels.

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Agricultural loans may be required in times of scarcity, as has been indicated above, and at other times to enable cultivators to replace cattle that have been lost by disease or accident: in ordinary seasons they are not likely to be required for other purposes.

10. There is probably not scope for large changes in methods of cultivation. The problem presented by the worn-out potato lands deserves further study than it has received. In the remoter villages the most hopeful line of agricultural improvements is probably the introduction of more valuable drugs and spices, the produce of which can bear the very heavy cost of transport. Within reach of markets, the promotion of market-gardening and orcharding is the most hopeful form of improvement. The development of sheep-breeding for wool is at present the subject of study.

11. It appears to be probable that the future development of the hills will be mainly on non-agricultural lines—extension of the tourist and pilgrim industry and of health resorts, manufactures based on forest produce, and possibly some utilisation of minerals. The first condition for any such developments is the improvement of communications: a programme of works has recently been drawn up for the district but it should not be regarded as exhaustive. The question of labour will however affect developments such as are indicated: the people are prosperous, and do not need to work steadily nor are they inclined to do so.

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DISTRICT NOTE.

GARHWAL.

Topography.

No agricultural statistics are prepared for this district, and the materials available for its description are therefore scanty. There is a narrow strip of *bhabar* lying below the hills, and some *Dun* country between the Himalayas proper and the outer Siwalik formation, but the bulk of the district is mountainous, consisting of a succession of deep gorges and steep hillsides, with small patches of cultivation, usually terraced, in places where the slopes are more gradual. The agricultural features vary widely with the position, soil, and altitude of each block; and the only general distinction that can be drawn is between the north and the south of the district.

The north which includes parganas Chandpur, Dewalgarh, Badhan, Nagpur, Dasauli and Painkhanda, is not entirely free from the danger of drought, but the crops are specially liable to injury from excessive rainfall. The south includes the parganas Barahsyun, Chandkot, Malla Salan, Talla Salan and Ganga Salan. This tract may suffer severely from defect in either the summer or the winter rainfall. The parganas of Chandkot and Barahsyun have a relatively dense population and high proportion of cultivation, and in places there is scarcely sufficient grazing for the cattle. Ganga Salan and Mala Salan on the other hand are unhealthy and sparsely populated. The foothills and *bhabar* compose the forest divisions known as Ganges and Garhwal: the forests in the rest of the district are managed by the Deputy Commissioner.

Water-supply.

The only sources of irrigation are the small channels (*guls*) led from the streams along the hillsides: they are made by the people interested, and from time to time require modification as the bed of the stream deepens. There is not enough cultivation in any place to give scope for extensive irrigation works.

Cattle-supply.

The district is fully self-supporting, and the cattle of pargana Chandkot have some reputation in the adjoining parts of the plains. Rinderpest and foot-and-mouth disease are common: other contagious diseases have not recently been reported. Rinderpest is exceedingly destructive, and in the last epidemic a strong demand arose for protective inoculation, much greater than could be met by the local staff owing to the difficulty of travelling.

Annals.

The first severe scarcity recorded was in 1877-78 when the southern tract suffered from the failure of the rains and distress was for a time acute. Scarcity was again prevalent both in 1890 and 1892, chiefly in the south of the district, being caused in each instance by failure of the winter rains: relief was given chiefly by the importation of grain by Government, the grain being either sold for cash or given out in advances. The northern parganas suffered from excessive monsoon rains in 1893 and again in 1894, and some advances for subsistence were necessary.

In 1896 deficient rain in both seasons produced more general distress and relief works were carried out while gratuitous relief was also given. The district was more fortunate in the following year and no distress was experienced then or in 1899, though the crops in the latter year were much injured by insufficient monsoon rainfall. In 1901 the *mandua* crop was injured considerably by locusts, and the following rabi was inferior in the south owing to deficient winter rains.

Favourable seasons followed: and though the winter of 1904-5 was extraordinarily severe the crops suffered little

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injury. The rains of 1905 were irregularly distributed and the rice crop was inferior. In 1906 the crops in both seasons were generally good, but locusts caused severe local damage, and much valuable land was washed away by the persistent rain of August. The rabi of 1907 was injured by excessive rain, and rinderpest increased, while foot-and-mouth disease caused serious losses. The rains were late and ceased early, and about half the kharif was lost, while want of winter rains destroyed most of the rabi of 1908 in the southern parganas. As the results of three bad harvests, food-supplies were seriously deficient, but on this occasion the necessity for importation by Government was avoided by the grant of advances to merchants who either imported grain or issued it at the foot of the hills on advance-orders given by the district staff. The system worked well, and grain to the value of about three lakhs was imported. Some relief works were also organised, and gratuitous relief was given more freely than hitherto.

The rains of 1908 were generally satisfactory, but they failed in September in the south-east pattis where the crops were very poor; and the rabi of 1909 suffered severely throughout the south from drought and dry winds. Some measures of relief were required from May to July. The following rains were much more favourable, though considerable loss was caused by landslips, while rinderpest reappeared. The rabi of 1910 again suffered in the south owing to want of rain between February and April. The monsoon was heavy and serious losses from landslips were again recorded, but the crops on the whole yielded well, while the rabi of 1911 was exceptionally good. Rinderpest however spread widely during the seasons, causing close on 4,000 deaths between April 1910 and March 1911.

Progress.

The absence of statistical data makes it impossible to say whether cultivation has expanded in recent years, or whether changes in the system of cropping have occurred, but apparently there has been some development in the production of spices which are grown for sale to a considerable extent.

Population increased substantially between 1891 and 1901 and more rapidly in the last decade. The lower rates of rural wages recorded in 1906 have apparently disappeared, and in 1911 the usual rate was 4 annas or more.

Advances for land improvement are not a normal feature of the district, but about Rs. 13,000 were taken in 1907-8 and smaller sums in the two following years. Advances for temporary purposes, mainly for the purchase of grain, are popular in unfavourable seasons, and in 1907-8 their aggregate was close on 3½ lakhs. No attempt has yet been made to organise agricultural co-operation in the district.

There has been a considerable advance in recent years towards making the district accessible: the railway was extended in 1897 to Kotdwara at the foot of the hills and a cart road has been constructed gradually to Lansdowne, while the improvements effected on the paths in the interior have made pack-traffic possible in several directions. The recent opening of the line to Ramnagar in Naini Tal is affecting the traffic in the south-east. There is still room for very great improvement of the road system, and in particular for a continuation of the cart road to Pauri.

The manufactures of the district are of local importance only, and no industry on a large scale exists. The district has however considerable resources other than its agriculture (which barely suffices to feed the inhabitants) and some of these have been developed materially. Large sums of money are spent by pilgrims, who have increased in number since the roads were improved: the development of the Lansdowne cantonment and the operations of the Public Works department have given increased employment; while increasing numbers of the people obtain seasonal work in Mussooree

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and Naini Tal, as well as in the plains. The employment outside the district has increased rapidly as is indicated by the returns of money-orders : about 1900 the sums distributed in the district aggregated about two lakhs annually, and about 1907 this had risen to four lakhs : but for the last three financial years the figures have been six lakhs, 5¾ lakhs and 6½ lakhs respectively.

Dangers and possible remedies or improvements.

THE HILL TRACTS.

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2. At the higher altitudes, roughly above 7,000 feet, where only a single-crop season exists, the nature of the winter is unimportant : the crops depend on the rainfall of the monsoon season. This is almost always sufficient or in excess, and excessive rain does considerable injury.

In the lower hills the kharif depends on both the spring rains and the monsoon, and the rabi on the winter rains. Rain in March and April is of great importance for the sowing of the unirrigated rice-crops, which takes place about April ; and this crop requires occasional storms to keep it alive until the rains arrive. An early commencement of the regular rains is desirable, but their continuance to the latter part of September is of much greater importance ; a cessation by the end of August leads to loss of a large proportion of the crops. Heavy rain does not appear to cause much direct injury to the crops, but its effects are serious when it causes landslips or destroys the terraced fields.

Landslips are frequently originated by unterraced cultivation on steep hill-sides, and such cultivation should be sternly discouraged.

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3. The rabi requires several falls of rain during the winter and it is important that the winter rains should continue at least into March in the lower villages and into April into higher.

There are very few records of injury from too much rain at this season; and no report of serious loss from rust on cereals has been received though the disease exists.

Serious injury from frost has not been reported.

4. Damage by ordinary insect-pests has not been reported in either season: but locusts enter the hills at long intervals and cause considerable injury where they settle.

Hailstorms in the spring may cause great local damage to cereals and also to garden-crops and orchards: they are of little importance in the winter.

5. So far as experience can be relied on, distress requiring measures of relief should not result from a single bad season, but it must be expected when the rabi crops fail after a bad kharif or vice versa. The danger is apparently greatest in the southern parganas but conditions may vary greatly from valley to valley, and each valley must be dealt with on its merits.

When distress occurs, the most important measure is to ensure an adequate supply of food in the distressed areas: where even in good years the local produce is insufficient; the system of advances to merchants and of grain-credit-orders introduced in 1903 will apparently serve this purpose effectively. Loans for subsistence and gratuitous relief are also likely to be required: there is ordinarily comparatively little scope for relief-works, but the opportunity should be taken of employing all surplus labour on improvements in communications.

6. There is no experience to show that a fodder famine is possible in any part of the hills; but with the increase of population and cattle there are indications of possible scarcity

in the future unless the grass supply can be improved by conservation.

7. No measures can be suggested for the direct improvement of the water-supply; and the question of drainage does not arise. The water-supply will however probably be improved considerably by the contemplated reservation of large forest areas.

8. There is sufficient pasture land for the cattle in most places, but it is not inexhaustible and difficulty is already being felt in places where cultivation is extensive. The reservation of forests will, it is hoped, improve the supply. The most important measure for the protection of cattle is the mitigation of disease, which is much more fatal than in the plains. The organisation of a system by which reports of outbreaks shall be promptly made, and the maintenance of a veterinary staff sufficient to prevent outbreaks from spreading are the essentials of the problem: but great difficulties arise from the obstacles to rapid travelling.

9. There is not much scope for the *takavi*-system in ordinary years. The chief agricultural improvement—the terracing of fields—must be carried out very gradually and cannot be done off-hand by the expenditure of capital; and improvement loans will probably be wanted only in exceptional cases for the construction or repair of water-channels.

Agricultural loans may be required in times of scarcity, as has been indicated above, and at other times to enable cultivators to replace cattle that have been lost by disease or accident: in ordinary seasons they are not likely to be required for other purposes.

10. There is probably not scope for large changes in methods of cultivation. The problem presented by the worn-out potato lands deserve further study than it has received. In the remoter villages the most hopeful line of agricultural improvement is probably the introduction of more valuable drugs and spices, the produce of which can bear the very heavy

cost of transport. Within reach of markets, the promotion of market gardening and orcharding is the most hopeful form of improvement. The development of sheep-breeding for wool is at present the subject of study.

11. It appears to be probable that the future development of the hills will be mainly on non-agricultural lines—extension of the tourist and pilgrim industry and of health resorts, manufactures based on forest produce, and possibly some utilisation of minerals. The first condition of any such developments is the improvement of communications: a programme of works has recently been drawn up for the district, but it should not be regarded as exhaustive. The question of labour will however affect developments such as are indicated: the people are prosperous, and do not need to work steadily nor are they inclined to do so.

THE BHABAR.

Conditions in the small *bhabar* tract are similar to those which prevail in Naini Tal. The prolongation of the rains through September is the most important point as drought at this time injures the kharif and restricts the rabi area.

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DISTRICT NOTE.

LUCKNOW.

Topography.

THE topography of the district can best be described with reference to the rivers. The Gumti flows between Malihabad and Mahona, then through the centre of Lucknow and then along the northern boundary of Mohanlalganj. The villages along its banks and for a varying distance on either side are more or less sandy, except in the neighbourhood of the city, where market gardens extend in places up to the river. Beyond the *bhur* on each side there is a stretch of *dumat* and then a larger stretch of heavy rice land. On the south-west there is another stretch of *bhur* along the Sai. The assessment circles show clearly the topographical features of the district, and the statistics for each circle will be found in the pargana handbooks.

Water-supply.

There are no irrigation canals. The well-survey showed that ordinary spring wells can be made in nearly all parts of the district, foundation-clay being met with at a reasonable depth. There are however 170 villages (out of 966 in the district) where these conditions do not prevail: practically all of these villages lie along the Gumti or the Sai, and most of them are situated in parganas Mohanlalganj (76), Bijnaur (28), Lucknow (25) and Nigohan (18). Temporary wells can be made in most parts of the district: the villages where their construction is most important in years of drought have been recorded in the survey. Irrigation from *jhils* is widely practised when water is available; temporary wells can be substituted in most places when the rains fail.

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Lucknow.

Cattle-supply.

There is no organised industry of cattle-breeding, the absence of any extensive pasture lands preventing its establishment. The number of cows kept in the district is small and the quality poor, while there are relatively very few sacred bulls, and practically no other bulls reserved specially for breeding. The district depends therefore mainly on imports for its working stock. The best cattle are imported from the Punjab and from Pilibhit or Kheri, while the bulk of the ordinary animals come from Bundelkhand or the central doab.

There has been little rinderpest of late years. Foot-and-mouth disease is common in the district, and haemorrhagic septicaemia also occurs. Hitherto there have been few opportunities of practising preventive inoculation, but it is probable that it would be accepted in a severe outbreak.

Annals.

Records of the earlier economic annals of the district are meagre. In 1877 the rains failed and there was next to no kharif; there was great distress and heavy mortality throughout the district. In 1880 again the rains failed; rice was almost a total failure, and as the *jhils* were dry much of the rabi could not be irrigated. After this the next record is of the great flood on the Gumti in 1894, when the whole of the lowlands suffered severely, the kharif being totally destroyed and many homesteads wrecked. In the following cold weather continuous rain did much injury to the rabi in the heavier soils. The series of wet seasons of which 1894 was the last did more damage than was recorded at the time; crop after crop was inferior in varying degrees and the people were gradually impoverished.

In 1896 the rains failed and the loss of kharif crops was severe and general, while rabi sowings for 1897 were restricted; distress was very severe throughout the district. A rapid

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recovery followed; for two years there were good seasons, and though there was some anxiety in parts of the district in 1899, when the rains ceased prematurely and much of the rice was lost, the later dry kharif crops gave an excellent yield, and there was no distress. From 1900 to 1902 the seasons were favourable, and cultivation recovered rapidly.

The yields for the years from 1903 onwards are given in the following table :—

Year.		Rabi.				Kharif.			
		All crops.	Wheat.	Gram.	Poppy.	All crops.	Rice.	Bajra.	Pulses.
1903	...	100	100	88	94	68	75	60	56
1904	...	94	87	56	100	100	94	94	94
1905	...	27	19	81	56	66	87	85	75
1906	...	96	100	92	113	87	90	105	100
1907	...	86	69	100	100	31	12	20	25
1908	...	87	87	75	75	89	87	95	87
1909	...	87	87	75	100	90	90	100	98
1910	...	104	106	106	81	89	97	90	81
1911	...	87	81	94	81	...	...	...	...

In 1903 the rains began late, and excessive falls in October caused serious injury to the kharif. The year 1904 was prosperous, but in 1905 the great frosts which occurred at the end of January and beginning of February almost destroyed the cereals and pulses, wheat suffering most. The following kharif suffered from deficiency of rain in the latter part of the season, and the same cause reduced the area sown in the succeeding rabi, which however yielded well. The kharif season of 1906 was favourable and the following rabi yielded well except in the case of wheat, which was affected by rust. The kharif area sown in 1907 was large, but the failure of the rains in September led to the loss of most of the crop, and to a large reduction in the rabi area of 1908.

Revenue was freely suspended and *takavi* liberally given, and at no time was distress serious. Recovery was somewhat delayed by the very severe outbreak of malaria in the autumn of 1908, which made it impossible to sow a full rabi area; but during 1909 and 1910 the district was prosperous. The rabi area of 1911 was almost up to the normal: wheat suffered from rust and poppy from blight owing to continued damp weather, but the other crops were good.

Progress.

The district was fully developed at the opening of the period under review, and the extension of cropping has not been marked. The cropped area is subject to fluctuations, the chief source of which is the varying extent to which a rabi crop can be sown after rice.

The class of crops shows a slight tendency to improve. The area under wheat has risen substantially; and cotton has become of some little importance. Sugarcane has never been sown on a large scale: the area at one time tended to expand, but has fallen again in the last few years. Market gardening has extended, and a regular export trade has sprung up in some classes of vegetables. Cultivation of groundnuts has begun in the last two years and promises to extend. On the other hand the area under poppy is being reduced.

Construction of masonry wells has been rapid in recent years, the number having risen from 6,667 in 1904-5 to 9,386 in 1910-11. The rate of construction was maintained steadily until the famine of 1907 when it increased rapidly, but since then a decline has apparently set in. In 1911 there was one masonry well to 29 acres of normal cultivation as against 39 acres in 1906. The area irrigated from wells in the famine of 1907-8 amounted to 116,000 acres as against 95,000 in 1896-7: the expansion was due partly to the increase in masonry wells and partly to the large advances given for constructing temporary wells. At the time of the well-survey

(1907) it was reported that tenants were usually willing to take advances but that many landholders objected to the practice. During the last few years the landholders' views have changed to a considerable extent, and hostility is now very much less common: it has almost disappeared among ordinary landholders, but a few talukdars still withhold facilities.

The population of the district rose between 1891 and 1901 but has fallen during the last decade; in 1911 it stood at 764,000 as against 774,000 in 1891.

Rural wages do not appear to have risen during the last five years: the rates ordinarily paid in 1911 ranged from 2 to 2¼ or 2½ annas.

Advances for land improvement—chiefly masonry wells—were taken steadily on a moderate scale between 1897 and 1905: the amount taken has increased considerably since then, varying from Rs. 8,000 to Rs. 24,000 in different years, while in the famine year 1907-8 advances aggregated several lakhs. Loans for temporary purposes have always been taken, but the amount has increased largely in recent years; some lakhs were given in 1907-8 and since then issues have varied from Rs. 20,000 to Rs. 76,000. The scope for such advances in years of drought is very great as it then becomes necessary to provide for the irrigation that in wet years would be afforded by the *jhils*.

A beginning has been made in agricultural co-operation. In 1911 there were 18 rural credit societies with 400 members, as well as a district bank at Mohanlalganj, and an early expansion of operations is expected.

The railway system has been extended during the last twenty years by the opening of the chord line to Benares, while additional stations have been provided on existing lines, and the district is now exceptionally well equipped.

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The length of metalled roads has been increased by nearly one-half in the same period, and not much remains to be done.

Rents have shown a steady upward movement during the last decade: the recorded rents for 1895-6, the first year after settlement, gave a rate of Rs. 6·6 per acre which was maintained practically unchanged until 1900-01. By 1910-11 the rate had risen to Rs. 8·0 per acre; the rise during the last seven years has been at the rate of Re. 1·8 per cent. annually or double the maximum rate authorized by the Rent Act.

The old hand-industries of the city have for the most part declined, but are being replaced as sources of employment by industries organised on more modern lines. The chief developments during this direction in the last twenty years have been the opening of oil and flour mills and an iron works, the large extension of the railway workshops (employing 5,000 hands in 1910), and the development of the printing industry. A cotton-spinning mill is in existence but has not recently worked. Outside the city, handloom-weaving has declined where it existed, and there have been no new developments. Very large sums of money are distributed in the district by money-order, but the statistics available do not show how far this income affects the rural population and how far it is earned by the trade of the city.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with occasional falls of rain. If the first month is wet sowing of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by large sowings of rice, and also of bajra and the late pulses which can be sown until nearly the end of August.

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The area under late rice is small: it varies with the weather during the second month of the season, when frequent falls of rain at short intervals are required.

The small area planted with surgarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains.

2. The yield of the early dry crops, of which maize and kodon are the most important, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops, which are the most important source of food, require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The small area under late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain but prolonged breaks are likely to cause injury.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

3. Apart from variations in the rainfall, the kharif crops may be exposed to the following dangers:

(*a*) *Floods on the Gumti and Sai.*—The area affected by floods is not extensive, but particular villages may require postponement of revenue and advances to secure the rabi; the need for advances should be considered particularly when homesteads have been injured or cattle lost.

(*b*) The juar crop may suffer from attacks of boring insects (see Provincial Note, section VI.)

(*c*) There are probably other insect-pests, and also fungoid diseases which have not yet been reported.

4. The rabi area depends mainly on the rainfall of September and early October. It may fall seriously if this season is dry, but the loss can be mitigated if financial assistance is given in time to enable the land to be tilled with irrigation.

5. The rabi yield depends to some extent on winter rains though in ordinary seasons these are not required for the large irrigated area. Falls in December and January are beneficial provided they are moderate in amount and of short duration: falls after the middle of February are likely to cause some injury: prolonged damp and cloudy weather in January and February is almost certain to produce rust on wheat and linseed, and very serious loss may result, the full

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extent of which may not be realised until the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring at the usual time, the beginning of January, does little harm except to the *arhar* crop and garden produce; a late frost may injure all crops and almost destroy the cereals as happened in 1905 when frost occurred in the first days of February.

The injury caused by hailstorms depends on the stage which the crops have reached; ordinarily a storm in early January does little harm, and the dangers become greater as the season advances.

Rape-seed may be seriously injured by the aphis which spreads rapidly if damp weather sets in while the crop is flowering.

The potato moth has recently secured a footing in the villages near the city, where the crop is largely grown (see Provincial Note, section VI.)

The poppy crop may suffer severe injury from damp weather late in the season.

7. The *zaid* crops are of some importance locally. Melons are largely grown, and may suffer from rain in April. The hot weather millet (here called *sawan*) is sown to an extent that varies with the shortness of the food-supply; it is injuriously affected by strong winds.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level might proceed so far as to render the masonry wells useless in some tracts, but this has not been known to occur.

On the other hand a series of wet seasons may raise the water-level to a point where the productivity of the land declines: this becomes obvious in the lowlands of the Gumti and the Sai where the land goes out of cultivation, but it is believed to occur to a less extent in the uplands also.

9. Distress requiring some measures of relief must be expected to occur if September and October are dry; its extent will depend largely on the position of the cultivators as determined by the results of preceding harvests, but probably most relief will be needed in the city and in the areas where rice is most largely grown.

The following relief measures were adopted in 1907-8.

Revenue suspended	kharif	Nil.
" "	rabi	Rs. 8,000.
Revenue remitted	kharif	2 lakhs.
" "	rabi	Nil.
Improvement loans		3½ lakhs.
Advances for rabi		4 "
" " kharif		1 lakh.

Maximum proportion of the population relieved 0·9 per cent. in March.

10. A serious shortage of fodder may occur in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass from the forests, and its distribution on the *takavi*-system. The demand will depend very largely on the winter

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rains; if there are none it may become very great, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder-famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficent size to supply fodder; but in such seasons juar occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognized beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. The most important action required for the improvement of the water-supply is a continuance of the present policy of pressing forward the construction of masonry wells wherever they are still required. The progress in the last five years has been very rapid, but it cannot yet be said that protection is complete. The measures to be taken include the offer of advances where required, the maintenance of boring-equipment to facilitate location of sites, and (where possible) securing the co-operation of those landholders who still refuse facilities to their tenants.

There may also be scope for facilitating the construction of embankments in the areas that depend on late rice (vide Provincial Note, section III).

12. There appears to be no urgent need for drainage works in the district, but the question should receive special attention if canal water is introduced.

13. In order to prevent losses from cattle-disease it is important that the system of prompt reporting prescribed by the Land Records Manual should be strictly enforced: and that the leaders of the people should popularise the idea of preventive inoculation so as to ensure the acceptance of the practice.

14. The district is not well supplied with agricultural capital. There are reasonable prospects of this defect being gradually removed by the extension of the co-operative organisation, but in the meantime the *takavi*-system should be generously worked. Improvement loans are required mainly for masonry wells, and to a less extent for embankments in rice areas; agricultural loans may be wanted in the following cases :

(*a*) On a very large scale in the event of a premature cessation of the rains. Loans will probably be wanted for the following kharif as well as for the rabi; there may also be a demand on a smaller scale in early spring for sowing sugarcane and *zaid* crops; while loans to buy fodder may be required.

(*b*) *On the occurrence of floods on the rivers* [vide paragraph 3(a)].

(*c*) *On the occurrence of cattle-disease.* In this case it is important that loans should be made available in time to provide cattle for next tillage-season.

(*d*) *Curtailment of the poppy area.* It may be desirable to offer advances in villages where the crop has been largely grown to enable cultivators to substitute some other remunerative crop.

15. There is not much prospect at present of improvements in agriculture requiring capital outlay being adopted by individual cultivators. The chance is greatest in the neighbourhood of the city where many market-gardeners are in a position to incur expenditure on improvements in their branch of agriculture. For the district generally the most suitable improvements are the introduction of new crops or varieties requiring the labour of the family rather than capital outlay; there is also some scope for the simplest forms of labour-saving implements.

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Lucknow.

The most hopeful prospect of effecting improvements by associated action lies in the development of the co-operative organisation: but possibly individual landholders may be found ready to serve as an agency for introducing improvements.

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DISTRICT NOTE.

UNAO.

Topography.

THE district may be divided into three tracts—the Ganges *khadir* on the south-west, the Sai tract on the north-east, and the upland in the centre.

(1) *Ganges* khadir.—This tract occupies almost the whole of Fatehpur Chaurasi, and the western side of Bangarmau, Safipur, Pariar, Sikandarpur, Harha, Ghatampur and Daundiya Khera; it is widest at the north and gradually narrows till at the extreme south of the district the river comes close under the high bank. The country is of the usual *khadir* type; in places there are stretches of barren sand or of hard clay, but most of the soil is fairly productive in favourable circumstances. It is frequently flooded during the rains and the kharif is exposed to great danger. In dry years the rabi is very remunerative, as very fair crops can be raised with little tillage. The main danger in this tract is that the land may get waterlogged after two or three wet years so that rabi cannot be sown: when this happens the deterioration is likely to continue till one or two dry seasons have passed; the land does not apparently recover in the first dry season.

(2) *The Sai tract.*—This tract includes the band of villages lying along the west of the Sai river in Bangarmau, Safipur, Gorinda-Parsandan, and Maurawan, and on both banks in Mohan-Auras and Asoha. The river valley is as a rule a wide shallow depression, and the villages are made up of this fertile lowland and of much poorer sandy land on the higher ground. After a run of wet seasons the depression gets waterlogged, *reh* appears on the land, and cultivation ceases,

The effect on the people is very serious as the inferior upland cannot support them. In moderately dry years on the other hand the tract is prosperous.

To the east of the Sai in Mohan-Auras there are some villages of stiff clay, joining on to the *matiar* tract in the west of Lucknow.

(3) *The upland.*—This tract is by no means homogeneous, but the information required for its complete analysis is not on record. Beyond the Ganges *khadir* there is usually a rich light loam, perhaps the finest soil in the district: in the north and centre this soil does not extend far inland, but towards the south, in the Baiswara parganas, there is a good deal of it. In places it extends right to the high bank of the river: elsewhere the bank is replaced by slopes of uneven *bhur*. Further inland the soil becomes much heavier, and there is a band of typical rice country through the east of Safipur, Unao, Harha, Purwa and Maurawan. East of this the land again becomes lighter and there is a good deal of *bhur* as the Sai is approached. The drainage is adequate in ordinary years, but after a run of wet seasons the lower parts get more or less waterlogged and the productive power of the district is gradually diminished.

Water-supply.

There are no irrigation canals, and the district is supplied by wells and *jhils*. The Ganges *khadir* does not usually require irrigation, but temporary wells can be made in most places if necessary. In the Sai tract temporary wells are not as a rule possible, and the absence of foundation-clay makes the construction of masonry wells a doubtful speculation. In the uplands wells, both temporary and masonry, can be made in most places. Discussion of the results of the well survey in this district made it clear that the district as a whole has not fully realised the possibilities of irrigation on the scale adopted in some neighbouring tracts; and as the survey was carried out from the standpoint adopted by the people its results are

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misleading. It has now been recognised that a considerable increase in the number of masonry wells is most desirable almost throughout the upland tract.

Irrigation from *jhils* is most important in parganas Maurawan, Asoha, Gorinda-Parsandan and Jhalotar Ajgain. A small amount of irrigation is done from the river in the Sai tract, but the cost of raising water by manual labour is excessive in the case of ordinary crops.

Cattle-supply.

There is no organised breeding industry, and little or no room for one. The number of village cows is low and the quality poor, while breeding bulls are not readily available. The district depends largely on imports. A few high class cattle are brought from the Punjab, but most of the good cattle come from Kheri, while the inferior stock is from Bundelkhand and the middle doab.

The district is liable to all the common forms of cattle-disease. The practice of preventive inoculation is now welcomed by the people.

Annals.

The reports show that in 1895 the whole district was more or less depressed as a result of the series of wet years; the depression was greatest in the Sai tract and the Ganges *khadir*, where the excessive rain of October 1894 left the land too wet for ploughing. The rains of 1895 were scanty and the crops poor, so that when the rains failed in 1896 the people were already at the end of their resources and the district suffered from severe famine, most of the later kharif being wholly lost and the rabi area of 1897 being restricted. The following year (1897-98) was good, but the *bhur* near the Sai in Asiwan and Mohan was reported to have suffered from a local deficiency of rainfall. The *khadir* and the Sai tract were generally improving rapidly under the influence of dry seasons, but two tracts (1) along the Kaliani nadi in Bangarmau and

Fatehpur Chaurasi, (2) in Sikandarpur, were still affected. The revenue was reduced temporarily in some of these villages and also in a few mahals scattered through the district which had been particularly hard hit by the famine. No further losses were reported up to 1903, and the statistics showed a general recovery of cultivation in the *khadir* and the Sai tract.

The yield of the harvest at each season from 1903 is given in the following table, but the earlier figures are probably somewhat understated owing to defects in the method of estimation:—

Year.	Rabi.					Kharif				
	All crops.	Wheat.	Barley.	Gram.	Poppy.	All crops.	Rice.	Juar.	Bajra.	Cotton.
1903 ...	90	94	94	70	88	57	75	62	37	50
1904 ...	87	87	87	87	97	87	94	87	69	81
1905 ...	29	13	25	50	75	45	25	30	70	80
1906 ...	77	94	81	69	69	88	90	81	94	113
1907 ...	83	50	94	100	75	34	6	19	37	37
1908 ...	90	103	103	62	69	75	31	75	94	56
1909 ...	79	81	87	56	75	83	65	69	100	75
1910 ...	100	100	100	100	87	86	81	62	81	75
1911 ...	95	87	94	106	69	...	...	...	...	...

In 1903 the rains began late and kharif sowings were delayed, while excessive rain in October caused much injury to the millets and cotton. The year 1904 was on the whole favourable, but in 1905 the rabi was very seriously injured by the exceptional frosts that occurred at the end of January and beginning of February; the loss was greatest in the case of wheat, which was almost destroyed, and poppy was the only crop that escaped severe injury. The autumn rains were late and were scanty throughout the season, so that the kharif crops were poor and the area under rabi in 1906 was materially reduced. In this season the cereals did well but *arhar* suffered from frost and the other crops from want of timely rain. The rains

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of 1906 were favourable, and consequently the area sown for the rabi of 1907 showed a marked recovery: the crops did well except wheat, which suffered from rust.

The rains of 1907 were practically confined to the month of August, and though a large area was sown the kharif gave a very small outturn, rice being an entire failure. With the aid of liberal advances, a substantial rabi area was sown in 1908: the cereals did very well but both gram and poppy were poor. There was some distress during this season but the proportion of the population requiring relief did not rise to one per cent. and all relief measures were closed by July. The rains of 1908 were again late and scanty: the dry crops did well, but rice was very poor and only a small rabi area could be sown for 1909. The winter rains were inadequate and most crops suffered. The rains of 1909 were early and at first heavy, but the September falls were insufficient for the rice crop, while *juar* suffered from insects. It was however possible to increase the 1910 rabi area substantially and the season was favourable. The rains of 1910 were again early and favourable; heavy falls at the end of the season affected cotton and *juar* injuriously but enabled a full rabi to be sown for 1911; the rabi season was favourable except for poppy which suffered from blight, while the wheat crop was slightly affected by rust.

Progress.

The district shows a very slight extension of cropping in the last two decades, and there is practically no room for further advance. Fluctuations in the cultivated area occur principally (1) in the Ganges *khadir* ; and (2) in the rice tracts of the uplands.

The class of crops shows a very slight tendency to improve. The chief extension is that of cotton, which has become important in the north of the district: sugarcane was at one time advancing but the advance has been largely lost of late years; the wheat area has been maintained, but poppy is being reduced. Groundnuts have lately been introduced in the north of the district, and promise to become popular.

The number of masonry wells rose by 23 per cent. between 1905 and 1911, reducing the cultivated area per well from 47 to 39 acres. The rate of increase was fairly steady until 1909, but it has slackened in the last two years. The area irrigated from wells in the famine year of 1907-8 was over 203,000 acres as compared with 173,000 acres in 1896-97: the increase was due partly to the larger number of masonry wells, and partly to the larger distribution of advances.

The population rose somewhat between 1891 and 1901, but there has been a serious fall (attributed mainly to the effects of plague) during the past decade; in 1911 the population was 911,000 as against 954,000 in 1891 and 977,000 in 1901.

Agricultural wages have risen in parts of the district during the last five years. The rates ordinarily paid in 1911 lay between 2 and 2½ annas.

Advances for land improvement—chiefly masonry wells—were given on a very small scale between 1898 and 1904. In the dry year 1905-6, nearly half a lakh was distributed, while since 1907-8 the annual issues have averaged over Rs. 22,000 as against less than Rs. 1,000 in the earlier period. Advances for temporary purposes were taken on a small scale up to 1907, but in the famine year very large sums were distributed, and since then the demand has been on a larger scale than before.

There has been a very marked development in agricultural co-operation. In 1911 there were 119 rural credit societies with over 25,000 members, while the Unao town bank had a working capital of six lakhs. Some of the societies have recently taken practical steps for the improvement of agriculture, and this movement is likely to show rapid development.

Unao.

Up to 1911 the railway system of the district was defective, being limited to the line across the centre, with one station to 297 square miles. The south has now been opened up by the line from Rae-Bareli, and if the proposed extension from Unao northwards is carried out the system will be practically complete. The length of metalled roads has been substantially increased in the last twenty years, but is still proportionately very small, and large extensions are desirable, especially in the north of the district.

Rents have moved rapidly in recent years. The records for 1894-95, the first year after settlement, gave a rate of Rs. 5·6 per acre, and this was practically maintained until 1901-2; a steady rise then set in and in 1910-11 the rate was Rs. 6·5. The increase in the last seven years is at the rate of 1·7 per cent. annually, or almost double the maximum permissible under the Rent Act.

Local industries are of very small importance, and are practically limited to weaving, which has declined under competition. Organised industries are represented only by a sugar refinery recently established at Unao.

The district derives a considerable income from employment outside its limits. The sums distributed annually in money-orders were about ten lakhs from 1898 to 1904: an increase was apparent from 1905 onwards, and from 12 to 14 lakhs are now distributed.

Dangers and possible remedies or improvements.

The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of rice, and also of bajra and the late pulses, which can be sown until nearly the end of August.

The area planted with late rice is determined mainly by the weather of the second month, when frequent falls of rain are required; a long break at this time will probably reduce the area materially.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food grains. Taking a longer view, the area is affected largely by facilities for marketing, and should extend further if gins and presses are established in the north of the district and if communications there are improved.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

2. The yield of the early dry crops, of which maize is the chief, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

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The small area under late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

Cotton is liable to considerable injury from excessive rain; the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

3. The kharif in the Ganges and Sai tracts may suffer from excessive floods. In such cases postponement of revenue and grant of advances may be required: advances are required in particular when homesteads have been destroyed or cattle lost. No further action should be necessary provided rabi can be sown, but if this is prevented by the state of the ground, special attention will be required and revenue may have to be suspended or remitted, as deterioration proceeds very rapidly in these tracts.

The juar crop may suffer from the attacks of boring insects (vide Provincial Note, section VI). There are probably other insect-pests, which have not yet been recorded.

4. The rabi area depends mainly on the rainfall in the latter half of September and the beginning of October; late falls may bring it considerably above the normal, while a dry September may lead to a very large reduction, which however can be mitigated by the timely grant of advances.

Late floods on the rivers may seriously reduce the rabi area in the lowlands if the ground remains wet till the sowing season is far advanced.

5. The rabi yield depends to some extent on winter rains, though in ordinary seasons these are not required for the large irrigated area. Falls up to the early part of February are beneficial provided that they are moderate in amount and of short duration: later falls are likely to cause some injury; while prolonged damp and cloudy weather in January and February must be expected to produce rust on wheat and linseed, and very serious loss may result, the full extent of which may not be realised until the crops are harvested.

When the ground has been dry at sowing time, and sowings have been made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring at the usual time, the beginning of January, does little harm except to the *arhar* crop: a late frost may injure all crops and almost destroy the cereals, as happened in 1905, when frost occurred in the first days of February.

The injury caused by hailstorms depends on the stage which the crops have reached: ordinarily a storm does little harm if it occurs before the cereals have begun to ear; the danger becomes greater as the season advances.

Rapeseed may be seriously injured by the aphis, which spreads rapidly if damp weather sets in while the crop is flowering.

The poppy crop may be seriously injured by damp weather late in the season.

7. The *zaid* crops are of very little importance in ordinary years, but the area may be very largely extended in unfavourable seasons.

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Unao.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts; this is not known to have happened, but about 1909 the supply in wells was seriously deficient over a large part of the uplands.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the low-lying tracts, and especially in the Sai valley which may go almost entirely out of cultivation.

9. Distress requiring some measures of relief must be expected to occur if September and October are dry: its extent will depend largely on the position of the cultivators as determined by the results of preceding harvests.

The following relief measures were adopted in 1907-8:—

Revenue suspended,	kharif	5½ lakhs
„ „	rabi	Nil.
Revenue remitted,	kharif	Nil.
„ „	rabi	Rs. 18,000
Improvement loans		¾ lakh.
Advances for rabi		3⅛ lakhs
„ „ kharif		1⅔ „
Advances to co-operative societies		1⅔ „

Maximum proportion of the population relieved 0·7 per cent. in March.

10. A serious shortage of fodder may occur in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi* system. The demand will depend very largely on the winter

rains: if there are none, it may become very great, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons juar occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognized beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. The most urgent need of the district is a considerable increase in the number of masonry wells. The standard of protection is distinctly lower than in Lucknow, and very much lower than in Rae Bareli; and though there have been considerable recent extensions in some parganas, it is still necessary that facilities should be provided, and that some at least of the more important landholders should be induced to exert themselves in the matter. Judging by the proportion of wells to rabi area, the number is sufficient only in the small pargana of Bhagwantnagar, and the deficiency is not large in Unao. The number of wells is relatively low in Purwa, Mohan-Auras, Jhalotar-Ajgain and Asiwan Rasulabad; and very low in Maurawan, Asoha and the Baiswara parganas other than Bhagwantnagar. Gorinda-Parsandan is worst of all, but in this case difficulties of construction are serious. Most of the parganas named show more or less progress in recent years, but very little has been done in Maurawan, a pargana which should receive special attention.

Apart from wells, it may be desirable to facilitate the construction of embankments for rice (vide Provincial Note, section III).

Unao.

12. There is at present no demand for drainage works, but a demand may arise in the event of a series of wet seasons recurring; and the district will need very careful treatment if canal-water is ever introduced.

13. Now that the practice of preventive inoculation has been accepted by the people, special attention should be given to securing the prompt working of the system of reporting cattle disease laid down in the Land Records Manual: and sufficient veterinary staff should be maintained to localise outbreaks where they occur.

14. The development of communications in the north of the district is an important matter, but the lines cannot be properly laid down until the question of a railway is decided: if a line is made northwards from Unao, bridged feeder-roads will be the most urgent need, while if the decision is against a railway a metalled trunk road must be the first step. The system of roads in the south also requires to be developed in order to get the full benefit of the new railway, and it is particularly desirable that the town of Maurawan should be served either by a light line or by any means of mechanical traction that may be suitable.

15. The district is naturally poor in agricultural capital: considerable areas have now the benefit of a co-operative organisation, but pending the extension of this source of supply the *takavi* system should be generously worked. The greatest need for improvement loans is for the construction of masonry wells, but smaller sums may be required for rice-embankments. Agricultural loans may be wanted in the following cases in particular:—

(*a*) *Early cessation of the rains.* Very large sums can be distributed with advantage to enable the rabi area to be sown: there may be a demand on a smaller scale about February for sowing sugar-cane and *zaid* crops, and a further demand for the kharif must be expected in June. Advances may also be required for the purchase of fodder.

(b) *Floods in the lowlands of the Ganges and Sai.* Advances may be needed for rabi sowings, especially if homesteads have been destroyed or cattle lost.

(c) *Losses by cattle-disease.* In this case advances should be made available in time to serve cattle for the next tillage season.

16. There are good grounds for thinking that agricultural improvements on a considerable scale can be introduced through the agency of the co-operative organisation, and work in this district should for the present be concentrated on these lines. The varieties of staple crops grown can probably be replaced in many instances by superior strains, and the simpler forms of labour-saving implements can be introduced with advantage; marketing on a co-operative basis should be a very great benefit in this district.

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DISTRICT NOTE.

RAE BARELI.

Topography.

THE whole northern half of the district is a plain of stiff soil where rice is the predominant crop; it is not, however, entirely dependent on this crop, as a second food crop is often obtained. This tract includes the whole of tahsil Maharajganj, pargana Rokhajais, and the first assessment circle in parganas Parshadipur and Rae Bareli. In the west of Bachhrawan and in Inhauna the soil near the rivers is lighter, but with these exceptions the tract is homogeneous.

South of this tract is the area occupied by the Sai and its tributaries, which consists of plateaux of light, and often poor, soil separated by stream beds: the inferior portions of this area give only coarse autumn crops, and water lies far below the surface. This area coincides with the second circle in Rae Bareli and Parshadipur, and the fourth circle of Salon. South of this again is what has been named the tract of interrupted drainage. This again is stiff rice land; there is a string of *jhils* (known generically as the *Naiya*) through the centre, and the villages more immediately along this imperfect drainage system are inferior, being liable to injury either in wet or in dry seasons. This tract includes roughly two-thirds of Khiron, the northern half of Dalmau, the second and third circles of Salon, and the third circle of Rae Bareli.

Finally on the south there is the Ganges tract, including the south of Salon and Dalmau and practically the whole of Sareni. The uplands are plateaux of light soil, separated by stream beds, but the land is much more fertile and secure than the somewhat similar tract on the Sai. The *khadir* is comparatively unimportant: in Dalmau there is a stretch of upper *khadir* where serious floods are not known to have occurred and where good crops can be grown without irrigation; elsewhere there is a narrow belt of the ordinary *khadir* type, which is flooded in the rains, and where inferior spring crops are grown with very little tillage.

Water-supply.

There are no irrigation canals, but the development of masonry wells has been very great, while temporary wells can usually be made in dry seasons to irrigate the land which in ordinary years is watered from *jhils.* Construction of masonry wells is popular, and at the time of the well-survey hostility on the part of landholders was reported to exist in only a few villages. Foundation-clay is usually met with, but was reported to be defective or absent in 129 villages, usually in the vicinity of one of the rivers; these are situated mainly in parganas Dalmau (29), Sareni (32), Salon (19), and Inhauna (18). The records of the survey show the villages where temporary wells are specially needed in seasons of drought, but the need is almost general.

Cattle-supply.

There is no organized breeding industry, and there are no large grazing tracts where such an industry could hope to establish itself. The number of cows is relatively higher than in Unao and Lucknow but is still low; their quality is poor, and few bulls are set apart for breeding. The district consequently imports a large proportion of its working stock. Cattle are very rarely brought from the Punjab: the better-class animals come from Kheri, and the rest from Sitapur, Bahraich, Bundelkhand and the middle doab.

The district is liable to all the common forms of cattle disease. There is not apparently much hostility to

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the practice of inoculation, but as yet it has not become popular.

Annals.

In 1877, when the rains failed throughout the season very little kharif was sown and practically none was harvested. The rain of October made it possible to sow rabi, but when work on this was over there was a period of severe famine, which was greatest in the northern rice tract. In the following spring the rabi suffered greatly from rust. In 1880 a long break in Spetember led to serious injury, three-quarters of the rice crop being lost; but rain came in October and enabled the rabi to be sown, and there was no severe distress among the labourers. The twelve years from 1881-82 to 1892-93 were on the whole satisfactory, but 1893-94 was poor, and 1894-95 bad; in the latter year the kharif was very bad and local relief works were necessary in the cold weather; excessive rain in October continued through the winter, did much damage to the rabi, valuable crops such as wheat and poppy suffering severely. The excessive rainfall too overfilled the *jhils* and land on their banks was specially injured, while attention was drawn to the need of a regular drainage system in the tract south of the Sai. Jealousies among the proprietors prevented any action in this direction. The next year was on the whole fair, but in 1896-97 there was severe famine. Rice was not sown at all in large parts of the rice tract, and the loss of the crop was general. The dry kharif was, however, saved in many places by irrigation, and with liberal assistance it was possible to sow a fair rabi area everywhere except in parts of Dalmau, Salon and Parshadipur. The rabi was good and distress disappeared at once on the arrival of the rains of 1897.

The seasons from 1898 to 1902 were prosperous, though the rice was slightly injured by the drought in 1899, and wheat was attacked by rust in 1901, and the district recovered rapidly. The seasonal yields from 1903 onwards are given in the following table :—

Year.	Rabi.					Kharif.			
	All crops.	Wheat.	Barley.	Gram.	Poppy.	All crops.	Rice.	Juar.	Pulses.
1903 ...	94	100	100	75	100	70	87	75	37
1904 ...	100	94	100	84	81	87	94	100	100
1905 ...	35	19	25	57	75	80	75	69	81
1906 ...	95	100	100	90	100	93	90	100	87
1907 ...	92	75	97	98	106	44	26	56	47
1908 ...	78	89	89	58	75	84	69	87	87
1909 ...	94	97	94	87	88	97	97	81	100
1910 ...	103	106	106	100	94	102	113	87	94
1911 ...	95	81	100	106	75	...	...	...	...

The rains of 1903 began late in July and were marked by heavy falls in October which damaged all standing crops except rice, but enabled a large rabi to be sown for 1904. This year was prosperous and a very large rabi area was sown for 1905. Exceptional frosts in the first week of February did great damage to all all crops, *arhar*, linseed and wheat suffering most. Wheat was also affected by rust, and rape was much injured by the aphis. The early portion of the rains of 1905 was favourable and a very large kharif area was sown : but drought in September caused substantial loss to the late crops and restricted the rabi area. The spring of 1906 was on the whole favourable, though *arhar* was damaged by frost, and the autumn crops were also successful.

In 1907 the rabi was again good except for wheat which suffered from too much rain. The rains of this year lasted only from 21st July to the end of August, and all crops suffered very seriously. With the aid of large advances, a substantial area was sown with rabi for 1908, and it was fairly successful with the exception of gram. There was only slight distress during the spring of 1908, and direct measures were

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almost limited to gratuitous relief. The succeeding rains were for the most part favourable, but September was too dry for late rice, and the effect of the drought, combined with a very widespread outbreak of malaria in October and November, was to restrict the rabi area, which fell below that of the previous year. The spring of 1909 was an anxious time: there was very little fodder, and the water-level had fallen so much as to make irrigation much more laborious than usual. The crops were however secured, and the prosperity of the district was fully restored by the three favourable seasons which followed in 1909 and 1910. The rabi harvested in 1911 was also good, and would have been exceptionally good but for injury to wheat and poppy caused by rain in March.

Progress.

The cropped area has increased in the last two decades, and there is no room for further expansion. The kharif area does not fluctuate greatly provided the sowing season is not altogether abnormal: the rabi fluctuates more widely, its extent depending largely on the possibility of sowing a second crop after rice.

The class of cropping shows no improvement, and the district is distinctly backward in this respect. Cotton is almost unknown, and where tried it has been disappointing: sugarcane is very little grown, and the area is not increasing; and the district relies for its cash income mainly on wheat and poppy. The wheat area has been maintained, but shows little tendency to increase, while the area under poppy is now being reduced, and the introduction of another cash-bringing crop is most desirable.

The construction of masonry wells has proceeded steadily and in 1911 there was one such well to 20 acres of normal cultivation (as against 22 acres in 1905); this proportion is considerably greater than in any other district of the division.

CSL

Rae Bareli.

The population has decreased slightly in each of the two last decades and in 1911 stood at 1,017,000 as against 1,036,000 in 1891; it is still very dense, the ratio of numbers to normal cultivation being higher than in any rural Oudh district except Partabgarh.

Agricultural wages have been practically stationary in the last five years; the rates recorded in 1911 ranged between 1½ and 2¼ annas.

Advances for land improvement—mainly masonry wells and to a less extent embankments in the rice tracts—have in the past been comparatively popular, ranging between Rs. 3,000 and Rs. 5,000 annually. In 1907-8 about 2¼ lakhs were distributed, and Rs. 65,000 in the two following years, but the issues for 1910-11 fell to Rs. 7,000. Loans for temporary purposes have increased largely in popularity since 1905: from Rs. 15,000 to Rs. 20,000 are now distributed in ordinary years.

There has been some development of co-operation in agriculture. In 1911 there were 78 rural credit societies with 1,900 members: the district bank had a working capital of 1¾ lakhs and a central bank had been founded at Salon. Some progress had also been made in the formation of urban credit societies in the town of Rae Bareli.

The district has benefited very greatly by the expansion of the railway system in recent years. Twenty years ago there was no station within its limits, but the opening of the Oudh and Rohilkhand chord line, and more recently of the extensions to Allahabad and Unao have made adequate provision for its requirements. The mileage of metalled roads has increased substantially in the same period, but is still low, and numerous feeder-roads are required.

The records prepared after settlement, that is in 1896-97, gave a rent-rate of Rs. 6·1 per acre. This was maintained with practically no change until 1901-2, but since then the rise has been rapid and in 1910-11 the rate was Rs. 7·1. The

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increase in the last seven years is at the rate of about one per cent. annually, or slightly more than the maximum permitted by the Rent Act.

Local industries other than weaving are of practically no importance. Weaving has suffered greatly under competition, while there has been no development of industry organized on modern lines.

The district derives a substantial income from employment outside its limits; the higher castes are accustomed to seek various forms of service, while low caste labourers migrate temporarily to Bengal. About 12 or 13 lakhs were distributed annually by money-order in the years from 1899 to 1904, and this figure has in recent years risen to about 15 lakhs or rather more than the revenue of the district.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of rice, and also of bajra and the late pulses, which can be sown until nearly the end of August.

The area under transplanted rice, which is proportionately most important in tahsil Salon, depends on the weather in the second month of the season. To secure a full area there should be frequent falls of rain at short intervals in this period, and bright sunshine is not desirable; a long break at this time will probably result in a marked decrease in the area planted.

2. The yield of the early dry crops, i.e. the small millets, as maize is not grown, depends mainly on the weather during the first two months of the season: alternations of rain

and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the small millets do best.

The late dry crops, which are of great importance both for food and for fodder, require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

The kharif cropping is not altogether well balanced, as too large a portion consists of the late crops. The introduction of maize in place of a proportion of the late millets would be an improvement from this point of view. A market-crop would also be an advantage: cotton cannot be recommended, and there are prejudices against sugarcane over large areas; there may be scope for a moderate area under groundnuts.

3. The kharif yield is not known to have been seriously affected by causes other than variations in the rainfall. The area exposed to river floods is small, and greater damage probably results from the extension of the *jhils* than from floods on the rivers. No serious injury from insect-pests have been reported, but probably the *juar* is affected by boring-insects (vide Provincial Note, section VI).

4. The rabi area depends mainly on the rainfall of September and the beginning of October; heavy falls in October give a substantial increase over the normal, while in a severe drought the area may fall greatly, but the fall can be mitigated by the timely grant of advances.

5. Provided that the seed bed has been sufficiently moist, the large irrigated rabi area is almost independent of winter rains, but the unirrigated area requires at least one fall.

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Rain is on the whole beneficial up to the early part of February, provided the falls are moderate and of short duration; rain after this period must be expected to cause some injury; while prolonged periods of damp and cloudy weather during January and February must be expected to produce rust on wheat and linseed, and possibly also on barley: the extent of the injury caused by rust may not be fully realised till the crops are harvested. Rain and damp weather in March appear to be particularly injurious to the poppy.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring at the usual period, the beginning of January, does little harm except to the *arhar* crop; late frosts, such as occurred in the first day of February 1905 may cause very great loss, particularly to the cereals. The extent of the loss will depend on the stage which the various crops have reached.

Hailstorms early in the season cause little injury; the danger from them increases as the season progresses.

The rapeseed crop is subject to serious injury from the aphis when damp and cloudy weather occurs at the time the plants are flowering.

7. The *zaid* area is relatively large: the crop chiefly sown is the hot-weather millet (known locally as *sawan*) and the area sown, which varies greatly, depends on the state of food stocks and the prospects of the rabi. In times of famine the price of seed may rise very high as a demand springs up over a large part of south Oudh and the stock in the country

is limited. The crop is always irrigated, and its outturn depends largely on the severity of the hot winds at the time it is ripening.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts; this is not known to have occurred, but after the last drought the fall was so great as to cause serious apprehensions.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines throughout the district.

9. Distress requiring some measures of relief must be expected to occur if September is dry; it is likely to be more severe in the two clay tracts and along the Sai than in the Ganges tract. The following measures were taken in 1907-8:—

Revenue suspended, kharif	2½ lakhs.
" " rabi	Nil.
" remitted	Nil.
Improvement loans	2¼ lakhs.
Advances for rabi	3 "
" " kharif...	2 "
" to co-operative organization ...	¼ lakh.

Maximum percentage of population on relief 1·0 in March.

10. A serious shortage of fodder may occur in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains: if there are none, it may become very great, but even light falls bring up enough grass to keep large numbers of cattle going.

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A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons *juar* occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognized beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. The habit of sinking wells is so thoroughly established in the district that the only action necessary is to continue the present policy of giving loans when required; and to endeavour to influence the few landholders who still fail to encourage construction on their estates.

Some action may also be possible in connection with embankments in rice tracts (vide Provincial Note, section III).

12. There is no present demand for drainage works, but the liability of the "interrupted-drainage tract" to injury in wet seasons should be borne in mind, and special attention should be paid to it if the drainage of the Ganges-Gogra doab comes under investigation.

13. Efforts are desirable to popularise the practice of preventive inoculation, and to enforce the prompt working of the system of reporting cattle-disease prescribed in the Land Records Manual.

14. Agricultural capital is provided by some of the landholders and the supply obtainable through the co-operative organization should steadily increase, but for the present there is room for an extensive use of the *takavi*-system. Improvement loans are required chiefly for masonry wells and for embankments in rice country. Agricultural loans may be needed on a very large scale in order to sow the rabi after a dry September, and further loans will probably be wanted first for the *zaid* crop and then for the ensuing kharif. Advances may also be required on the occurrence of cattle

disease, when it is important that cattle to replace losses should be obtained before the next tillage season.

15. It is probable that the co-operative organization will shortly be sufficiently developed to carry out important organized improvements in agriculture, while it may also be possible to work through the owners of some of the larger estates. The chief need of the district appears to be for a larger acreage under remunerative crops (vide paragraph 2 above): and this point should be specially considered for any areas in which it becomes necessary to stop poppy cultivation. The extension of maize cultivation would also improve the position in seasons when the rains cease early. Improvements through individual initiative are at present unlikely, beyond the adoption of better varieties of existing crops or of a new crop such as groundnuts.

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DISTRICT NOTE.

SITAPUR.

Topography.

THE district lies between the Gumti on the west and the Gogra on the east, and is divided into four main tracts: *bhur* on the west, *tarai* and *ganjar* on the east, and loam in the centre.

The *bhur* includes most of parganas Gondlamau and Aurangabad, half of Chandra and the western edge of Misrikh. It varies in quality, Gondlamau being particularly bad: but all of it is exposed to the risk of loss from drought as temporary wells cannot be made and no other means of irrigation exist. It also suffers from flooding in wet years.

The *ganjar* tract on the east includes parganas Tambaur, Kundri north and Kundri south and the eastern fringe of Biswan. It is constantly swept by violent floods from the Chauka and other rivers and grows little kharif except some precarious rice, while the rabi cultivation is poor. Irrigation is not needed as a rule.

To the west of this is a belt of *tarai* in parganas Laharpur, Biswan, Sadarpur and Mahmudabad, its western limit following roughly the line of the Bahramghat-Lakhimpur road. The soil of this tract is mainly clay: it is exposed to floods in the rains, but the water does not sweep the country as in the *ganjar*, nor does it rise to the same height. A good rice crop can often be obtained and a fair rabi grown without irrigation, and drought causes little anxiety.

The central loam tract occupies the west of the district between the *tarai* and the *bhur*. It is not entirely uniform in character as there are differences in level: the high ground ha the lighter soil and is more likely to suffer in dry than in wet years: the low ground is stiffer and liable to injury from over-saturation. The central part of Chandra may be included in this tract as it is of the same character though separated from it by a stretch of *bhur*.

The lowlying portions of this tract are enumerated as follows by the settlement officer:—

(*a*) The centre and north of Maholi, the north of Sitapur, Khairabad, and the east of Hargaon. These four portions form one block broken only by the Sarayan Nadi which is here ineffective as a drainage channel.

(*b*) The centre of Misrikh, the west of Ramkot, and the north of Machhrehta. These portions lie close together, but do not apparently form one block.

(*c*) The east of Pirnagar, the south centre of Biswan, and a depression running through parganas Bari and Mahmudabad. These appear to form practically a continuous block of country.

Permanent sources of water-supply are rare in this tract. Temporary wells can, however, be made in the greater part of it, but difficulties are found owing to the sandy sub-soil in parts of Gondlamau, Pirnagar, Khairabad, the east of Ramkot, Laharpur and Biswan. In Hargaon and part of Sitapur, which together form a block of bad land and bad cultivation, the tenants are frequently too poor to make wells.

Water-supply.

There are no irrigation canals. The number of masonry wells is very small, and hitherto the people have relied on temporary wells which can be made almost everywhere in the loam tract, while the *bhur* tract has no resources.

The well-survey showed that foundation-clay is not generally met with down to the depths of which the people

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have experience, and wells sunk without trial borings are likely to prove unsuccessful. A considerable number of trial borings have been made in the district since the well-survey was carried out, and foundation-clay has been discovered in about three borings out of four, usually about 100 feet below the surface. Ordinary masonry wells cannot therefore be recommended, but semi-artesian wells of the type described in the Manual of Irrigation Wells are economically practicable in many localities.

Cattle-supply.

Professional breeding is carried on by a few residents of Misrikh and Biswan tahsils, whose herds graze in Pilibhit and Kheri forests, except during the rains when the banks of the Kathna river are prepared. The district has also a fair stock of cows, mostly of impure Kheri strains, and large numbers of cows are concentrated in particular villages of the tahsils mentioned.

Western cattle are scarcely ever brought into the district. High-class stock come in from Kheri, while local stock are exported in considerable numbers both to Rohilkhand and to south Oudh, and as far east as Azamgarh.

The district is liable to all the common forms of cattle disease. The practice of inoculation is now welcomed by the people.

Annals.

The following information is derived from the annual reports:—In the run of wet years ending in 1895 the *ganjar* and *tarai* suffered greatly from floods and the *bhur* was affected by the same cause. The year 1895-96 was dry and the *ganjar* was greatly benefited but the *bhur* suffered again. In 1896-7 Sitapur was classed as a famine district: the area cultivated during the year was not greatly reduced, except in the *bhur*, where it fell below normal by about twenty-five per cent., but the yield of both harvests was poor: the kharif was slightly over half a normal crop and the rabi about the same. In 1897-98 recovery was rapid, though much damage was caused by floods in the *ganjar*. The following years were prosperous, until the rabi of 1901, when wheat and linseed suffered very severely from rust. In 1902 the rice crop suffered from a prolonged break and pulses from rain at the end of the season.

The seasonal yields since 1903 are given in the following table :—

Year.		Rabi.					Kharif.				
		All crops.	Wheat.	Barley.	Gram.	Poppy.	All crops.	Rice.	Small millets.	Pulses.	Sugarcane.
1903	...	84	94	100	75	81	57	59	75	40	94
1904	...	94	90	94	78	94	87	87	100	87	81
1905	...	44	44	57	50	Not available.	87	81	94	81	100
1906	...	92	94	94	87	100	87	84	94	87	100
1907	...	70	50	94	75	94	13	4	17	6	50
1908	...	90	100	100	75	50	75	50	94	44	75
1909	...	71	62	87	44	75	84	81	92	75	94
1910	...	100	100	100	100	100	86	87	87	87	94
1911	...	87	81	87	100	69	...	...	...	...	...

A large rabi area was sown for 1903; it suffered somewhat from want of rain and also from frost. The rains began late and were light at first but excessive at the end of the season. Rice suffered from drought, while the late millets and pulses were seriously injured by the rain in October. A very large rabi area was sown for 1904 and was successful in spite of the want of winter rains. The rains began early and kharif sowings were extended: the *ganjar* tract suffered from floods and other crops were affected by a break in September. Rain at the end of the month again secured a large rabi area for 1905: the crop

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was however very seriously injured by the exceptional frost at the beginning of February and wheat also suffered from rust. The rains were favourable until September when rice and pulses suffered somewhat from drought. In 1906 the rabi area was reduced by the want of moisture, but the yield was generally satisfactory. The rains were normal on the whole, but rice suffered from a break in August and September.

A very large rabi area was sown for 1907. The latter part of the season was damp and cloudy, and wheat was seriously affected by rust. The rains of this year were confined to the period from 21st July to end of August; considering the season, a remarkably large area was sown, but the yield was very poor, while the ground was so dry that the rabi sown for 1908 was little more than half the normal. The district was severely distressed: relief measures began in December 1907 and were closed in September 1908; the maximum numbers relieved rose to 7·5 per cent. of the total population. Such rabi as was sown was successful, and although the rains of 1908 were late in arriving a very large area was sown for the kharif. Drought in September affected the crops somewhat seriously, and the same cause joined with a very severe outbreak of malaria kept the rabi area of 1909 very low, only ten per cent. above that of the famine.

The 1909 rabi was not very successful, the soil being dry and the rainfall slight. In this year the rains were early and were satisfactory until the end of August, but were again scanty in September. The *ganjar* tract suffered severely from floods. The rabi area of 1910 rose largely but was still much below the normal: the season was very favourable, and the rains of this year were satisfactory until the end of the season heavy falls in October reduced the yield and the *ganjar* again suffered severely from floods. In 1911 the rabi area was at last brought up to the ordinary standard, and the yield was fairly good, though greatly reduced by excessive rain in March, which affected both poppy and wheat.

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Progress.

Twenty years ago cultivation was still tending to expand, but the limits of profitable expansion appear to have been reached some years ago. The class of crops shows little tendency to improve. The wheat area has remained constant for the last ten years after having risen in the previous decade; and no expansion has been established in sugarcane or other high-grade crops, while the large area under poppy is in process of reduction. A tendency to increase the small area under cotton appears to be coming into existence, but otherwise the district is at the present time stationary.

The number of masonry wells shows a relatively large increase (40 per cent.) during the last six years, but it is still very small indeed, there being one well to 259 acres of normal cultivation; and it cannot yet be said that the practice of using such wells is established except in a few localities.

The population of the district increased rapidly between 1891 and 1901, but some of the increase has been lost during the last decade; in 1911 it stood at 1,139,000 as against 1,075,000 in 1891.

Agricultural wages are low and have not apparently risen during the last five years: the rates recorded in 1911 ranged from 1½ to 2 annas.

Advances for land improvement were taken on a relatively large scale in the years succeeding the drought of 1896: the demand then fell away, but in the drought of 1907-8 a large amount was distributed, and substantial sums were taken in the two following years. Loans for temporary purposes are popular, and the demand is very large in abnormally dry seasons as temporary wells are practically the sole resource of the district.

Up to 1911 agricultural co-operation had made practically no progress, though three small societies were in existence.

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Sitapur.

A trained organizer has recently started work in the district and expansion is anticipated.

The railway system of the district has been largely extended during the last few years by the construction of three lines, the broad-gauge routes to Shahjahanpur and Balamau, and the narrow-gauge line through the south-east to Burhwal. In 1911 there was one station to 125 square miles, as against 322 square miles in 1891. The mileage of metalled roads has been substantially extended, and the principal need is now for short feeders to the new lines of railway.

Rents rose at first rapidly after the completion of the settlement. The records for 1897-98 gave an average rent-rate of Rs. 5·8, and by 1906-7 the rate has risen to Rs. 6·7. Since then it has remained approximately constant.

The only local industry of any importance is weaving and this has declined seriously owing to stress of competition. No industry has been organized on modern lines.

The district derives very little income from external sources: the sums distributed by money-order are about 3½ lakhs annually, and there has been no extension during the last decade.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops other than rice depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, but the loss will usually be made good by larger sowings of rice, and also of bajra and the late pulses, which can be sown until nearly the end of August. The cropping is on the whole so balanced that the total area is fairly well maintained in all but the worst seasons.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

2. The yield of the early dry crops (maize in the lowland and small millets in the upland), depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best, while it may suffer seriously in a prolonged break.

The late dry crops require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry. Juar is little grown, but bajra is of great importance, and the late pulses are a special feature of the agriculture of the district.

The small area under late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

The balance among the earlier crops is fairly satisfactory as the rice and millets are to a great extent compensatory, but the large proportion of the area sown with late crops makes the upland tracts very sensitive to a premature cessation of the rains.

3. The kharif crops in the *ganjar* and *tarai* tracts may suffer severe injury from floods on the rivers. The injury is unavoidable, and can be mitigated only by measures such as the postponement of revenue and the offer of advances to sow rabi: the lasting effects of a severe flood depend very largely on the condition in which the land is left, and if it is too wet for sowing rabi or has been spoilt by sterile silt, the burthen of the revenue may require to be temporarily reduced.

No serious damage from other calamities has been recorded in recent years, but the risk of loss by insect-pests must be borne in mind.

4. The rabi area fluctuates considerably, and may fall by as much as one-half if the rains cease prematurely: as there are practically no permanent sources of irrigation, the need for temporary wells becomes exceedingly urgent in such seasons.

5. In seasons when the rabi seed-bed has been sufficiently moist, winter rains are within certain limits a great benefit but are not absolutely indispensable. Falls are valuable up to about the middle of February provided they are moderate in amount and of short duration: falls in March are ordinarily somewhat injurious; and prolonged damp and cloudy weather between January and March must be expected to result in rust on the cereals and linseed, causing injury the full extent of which may not be recognised till the crops are harvested. Damp weather in March may also result in blight on the poppy.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry

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winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring at the usual time, the early part of January, does little harm except to the *arhar*, but late frosts, such as occurred at the beginning of February 1905, may cause very serious damage, particularly to the cereals.

Hailstorms do not cause serious loss until the cereals are beginning to ear; the danger from them increases as the season progresses.

The rapeseed crop may be greatly injured by the aphis if damp and cloudy weather occurs while the plants are flowering.

7. The *zaid* crop is of little importance in ordinary seasons, but it extends considerably when deficient rains have led to a shortage of food; in such seasons advances will probably be required to enable a large area to be sown.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will probably be most noticeable in the *tarai*, the ***bhur*** and the lowlying areas of the loam.

9. Distress requiring some measures of relief must be expected to occur in seasons when the rains have ceased by the beginning of September. Its extent will depend largely on the resources of the people as determined by

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previous harvests. In 1907-8 the following measures of relief were taken:—

Revenue suspended, kharif	1¾ lakh.
" " rabi	¾ "
" remitted, kharif	¾ "
" " rabi	Nil.
Improvement loans	1¼ lakh.
Advances for rabi	8 lakhs.
" " kharif	2¼ "

Maximum percentage of population relieved 7½ per cent. in February.

10. A serious shortage of fodder may occur in seasons when the rains have ceased so early that the late crops wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains: if there are none, it may become serious, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons juar occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. The question of improving the water-supply is one of some difficulty. In ordinary seasons one watering at most is sufficient for the crops, and this can be given from temporary wells. But in seasons of drought much more water is required, and then the temporary wells may fail before the crops are secured. As has been indicated above, it has now been ascertained that semi-artesian wells are practicable over large areas; it is impossible to say *a priori* whether the

construction of these is a sound investment, and the people must decide this question for themselves. It is desirable that Government should (1) advance where necessary the capital required by any one who wishes to sink a well : (2) maintain an adequate boring staff to assist in locating sites and subsequently in sinking pipes to the foundation-clay : (3) arrange with landholders for a sufficient number of such wells to be sunk over the district to enable the people to gain practical experience of their value. More general action cannot be recommended at present.

There may be scope in some localities for embankments to retain water for the rice crop (vide Provincial Note, section III).

12. There is at the present time no demand for drainage works; but the lowlying portions of the loam tract should be watched in the event of wet seasons recurring, and possibly the need for drainage cuts may be established.

13. Cattle form a considerable portion of the wealth of the district, and the prevention of losses from disease should receive special attention. Now that the practice of inoculation has become acceptable, the chief needs are to ensure the prompt reporting of every outbreak under the rules contained in the Land Records Manual, and to maintain a sufficient staff to secure that preventive measures can be taken in time.

14. The district is not well supplied with agricultural capital. There is hope that the need may be gradually met by the co-operative organisation, and some of the larger landholders provide for the needs of their tenants, but for some time to come there will be plenty of scope for the *takavi*-system. Improvement loans may be wanted mainly for wells, and possibly also for embankments. Agricultural advances are likely to be required in the following cases :—

(*a*) *When September is dry.*—In this case advances for the rabi are of vital importance to most parts of

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the district: there may be further demands on a smaller scale about February for sowing sugarcane and *zaid* crops, and probably large sums will be required in June for the kharif.

(*b*) *On the occurrence of floods in the lowlands* (vide paragraph 3 above).

(*c*) *In the event of losses from cattle disease.* In this case it is important to enable cultivators to replace their working cattle before the next tillage season: while if there has been a serious loss of cows in breeding villages, the question of offering advances to enable them to be replaced should be taken into consideration.

(*d*) In the event of poppy cultivation being stopped in villages that now depend largely on it, so as to enable the people to establish an alternative crop.

15. It is possible that improvements in agriculture by associated action may be found possible on some of the larger estates, but if a co-operative organisation develops as is hoped it should be the most suitable agent. The cropping of the district requires to be examined in detail before definite recommendations can be made for its improvement, the varieties of sugarcane and cotton receiving special attention. There is probably also room for the simplest forms of labour-saving machinery; and the tillage of the *ganjar* tract should be examined to see if time-saving implements can be introduced with advantage.

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DISTRICT NOTE.

HARDOI.

Topography.

THIS district presents considerable variety of natural features; the main divisions lie roughly north and south, or parallel with the Gumti which forms the eastern border, and may be termed—

(1) the Gumti *bhur*,

(2) the eastern upland,

(3) the Sai basin,

(4) the western upland,

(5) the western slope,

(6) the Pachhoha-Pali *bhur* (on the north), and

(7) the lowlands (south of Pachhoha-Pali *bhur*).

1. *The Gumti* bhur.—This tract consists of a fringe of varying width along the eastern border of parganas Pandarwa, Gopamau, and Sandila, and the north-east of Kalyanmal and Gondwa. In a few places there are small areas of lowland along the river, which are productive in ordinary years, but become waterlogged in a run of wet seasons. The *bhur* itself is mainly of the worst type, sand-hills and ravines, but there are stretches of better soil in places. Irrigation is difficult or impossible, and the land suffers severely in a drought; but it suffers almost as much from excessive or untimely rain. Frequent fallows are necessary for all but the best soil.

2. *The eastern upland.*—This tract is narrow in the north, but widens considerably towards the south; it includes

the country between the Gumti *bhur* and the Sai basin, namely, the centre of Pandarwa and Gopamau, the east of Balamau, and the greater portion of Sandila, Kalyanmal and Gondwa. The soil is either loam or clay with stretches of *usar* towards the south, and numerous *jhils*. These supply most of the irrigation in ordinary years. The northern part of the tract is adequately drained, but the natural drainage is imperfect in parts of Sandila.

3. *The Sai basin.*—This is a narrow depression, traversed by the Sai (also called the Bhainsta). The depression itself is loam or clay and is productive in ordinary years, but suffers greatly from waterlogging in a run of wet seasons; the higher land along the edges of the depression is light loam or *bhur*, in quality much better than that on the Gumti, but difficult to irrigate. This tract lies in parganas Pandarwa, Alamnagar, Mansurnagar, Sara south, Gopamau, Bangar, Mallawan Balaman and Sandila. In the northern parganas (Pandarwa Alamnagar) there is a good deal of jungle and the villages along it suffer from wild animals. There appears to be sufficient irrigation except in the *bhur*.

4. *The western upland.*—This tract extends from the Sai basin on the east to the western edge of the upland, where the land begins to fall away to the Garra and the Ganges. It includes most of Alamnagar, Shahabad, Monsurnagar, Sara north and south, Bawan and Bangar, the east of Bilgram and the centre of Mallawan. In pargana Shahabad the western villages run down into the Garra *tarai* and are very fertile; but further south the quality of the *tarai* changes and it is included in a separate tract. The soil of the main tract is good fertile loam, getting lighter towards the west where it passes into the *bhur* of the western slope. Except in Bilgram and Mallawan the loam depends mainly on *tals*, which fail in dry seasons. The south of the tract is well drained; but in the north the land is lowlying and wet

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seasons have in the past caused much loss in Alamnagar, Mansurnagar, Sara (north and south), and Bangar.

5. *The western slope.*—This is a narrow strip of broken sandy land falling away from the upland to the level of the rivers. It is not prominent in the most northern pargana (Shahabad), but becomes distinct in Saromanagar, and extends through Barwan, Sandi, Bilgram, and the west of Mallanwan. It is marked by the sandiness and poverty of the soil and the difficulty of irrigation.

6. *The Pachhoha-Pali* bhur.—This tract lies in the north-west of the district between the Garra and the Sendha, the latter tributary of the Ramganga. It includes practically the wholea of Pali and Pachhoha, and a narrowing strip of *bhur* continues from it into the lowlands further south. There is some lowland along the streams, and this is the best part of the tract, but it always liable to flooding and is not very productive even in favourable seasons. The rest consists of high ridges of *bhur* intersected by long *jhils;* the *bhur* is of the worst kind with numerous shifting sand-hills. The tract is particularly sensitive to variations in the rainfall; irrigation is hardly possible so that drought causes much loss, while excessive rain injures the lowland and at the same time reduces the productivity of the *bhur*.

7. *The lowlands.*—The Ramganga enters the district at the south of pargana Pali and from this point its lowlands form practically one tract with those of the Garra, though the higher sandy land extends for some way between them. A little further south the Ganges becomes the western boundary and is joined by the Ramganga which has just before received the Garra. The lowlauds comprise the west of Saromanagar and Barwan, most of Sandi, the whole of Katiari and Kachhandau, and the west of Bilgram and Mallanwan. The kharif in this tract is liable to destruction from floods, which, however, leave a very fertile silt yielding excellent rabi if the

flood recedes in time for cultivation. Irrigation is not usually needed, but a particular feature of this tract is the extent of heavy clay which dries so rapidly that it cannot be cultivated without good rain at the end of the monsoon. The existence of this clay is recorded in Sarromanagar, Sandi, Kachhandau and Mallanwan, and deserves special note because the Ganges *khadir* is in many places seen at its best in a dry year.

While almost the whole tract is subject to floods, the danger of waterlogging varies in different places; it is greatest between the high ground and the Garra; between the Garra and the Ramganga there is much less danger, while west of the latter river waterlogging is practically unknown and the soil is very easily tilled.

Water-supply.

The *bhur* tracts have practically no sources of irrigation: temporary wells cannot be made owing to the nature of the sub-soil, and foundation-clay is not known to exist. It is possible that clay may exist at considerable depths, but much of the land is too poor to bear the cost of expensive wells even if they should be found possible.

In the upland tracts the facts known to the people regarding the foundation-clay have been recorded for each village in the well-survey. The only general statement that can be made is that its distribution is so irregular as to make trial borings a desirable preliminary in all except a few favoured villages. Hostility on the part of landholders was not recorded, but the practice of sinking masonry wells is not usual in the greater part of the district.

Temporary wells can be made almost everywhere except in the *bhur*: as a rule they are of the simplest type and worked by hand-lifts, but in ordinary seasons they suffice to mature a substantial area of irrigated rabi; their liability to fail in a drought has been recorded in portions of parganas Gondwa, Alamnagar, Sara south, Bawan, and Barwan.

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Hardoi.

Cattle-supply.

There are a few small herds belonging to professional breeders, who live in the neighbourhood of *Pihani* but keep their stock most of the year in the Kheri forests. Apart from these herds, the number of cows in the district is low and the quality poor, while bulls are rarely set apart for breeding. Cattle are brought into the district in small numbers from the Punjab, and in larger numbers from Kheri, Rohilkhand and the middle doab: while local young stock are taken in small numbers to Sultanpur, Budaun and some other districts.

The district is liable to all the common forms of cattle-disease. The practice of inoculation is still regarded with suspicion by the people.

Annals.

The first annual report was received for 1894-5. In that year nearly the whole district was reported to be suffering from floods and waterlogging, the result of a run of wet seasons; the obstacles to drainage projects were described as the poverty of the landholders and their diverging interests. About this time cattle disease (probably rinderpest), had caused great loss in the Pali-Pachhoha *bhur*.

In 1895 the rains were deficient, and ceased early in September, injuring the kharif and reducing the rabi area. The absence of winter rains was injurious to the rabi of 1896, and as the result of these successive losses the district had become much impoverished and relief-measures were necessary during the hot weather.

The rains of 1896, not unfavourable at first, ceased in August. Most of the kharif was destroyed, while the rabi area of 1897 was greatly reduced, and (little water being available) gave a very poor outturn. Acute famine conditions prevailed throughout the greater part of the year: the loss of cattle was described as enormous; many cultivators migrated to more prosperous districts; many were reduced to the status of labourers, and the decrease in the agricultural population was obvious in the ruined houses and deserted hamlets. Large numbers of masonry wells were constructed about this time with the aid of advances.

The resettlement of the district was being completed about this time, but the loss caused by famine necessitated extensive reductions in revenue, which were carried out gradually until 1902.

In 1897-8 the seasons were more favourable and recovery began, but in 1897 there were serious floods in the lowlands of the Ganges. In 1899 the want of September rain injured the kharif and reduced the 1900 rabi area, mainly in the western upland, the Pali-Pachhoha *bhur*, and the clay tracts in the lowlands. The following three years were particularly favourable; no serious calamity of any sort was reported, and by 1902 the district could fairly be described as prosperous.

The yield of the harvests from 1903 is given in the following table:—

Year.	Rabi.					Kharif.			
	All crops.	Wheat	Barley.	Gram.	Poppy.	All crops.	Rice.	Bajra.	Cotton.
1903 ...	83	94	94	81	94	60	78	50	70
1904 ...	100	94	94	87	94	90	94	90	85
1905 ...	52	44	44	87	87	75	62	81	85
1906 ...	92	94	94	87	100	87	90	106	105
1907 ...	79	56	97	94	100	81	19	40	50
1908 ...	78	81	94	43	50	84	56	95	85
1909 ...	84	81	87	75	100	93	84	100	100
1910 ...	100	100	100	103	75	85	87	87	80
1911 ...	90	81	94	106	87	...	...	...	...

Hardoi.

The rains of 1903 began very late, but they were favourable during August and September. Heavy rain in October caused much injury to the millets and cotton. A large rabi was however sown for 1904 and was successful. The succeeding rains too were favourable, and a very large rabi area was sown for 1905. The cereal crops suffered very serious injury from the exceptional frosts at the beginning of February: it was noticed that the best land and best crops suffered most, the late sown crops on the *bhur* being so backward as to escape severe damage.

The rains of 1905 were unequally distributed and deficient in the latter part of the season. The rabi area of 1906 was reduced in consequence, but with favourable winter rains the yield was fair. The rains were usually satisfactory except in the south of the district, where they were in defect. The rabi area of 1907 extended and most crops did well with heavy winter rains: wheat was an exception as the crop suffered seriously from rust.

The rains of 1907 began only at the end of July and ceased at the end of August. A large kharif area was sown under unfavourable circumstances, but the yield was very bad, and the rabi area of 1908 fell by over 40 per cent. The crops suffered from insufficient moisture, and deteriorated rapidly under the west winds of March; gram was (as usual in such seasons) the least successful. Relief operations became necessary in November 1907 and lasted until July 1908: some regular relief works were required but distress was not serious, and the total number relieved did not at any time rise above 2½ per cent. of the population. The rains of 1908 began late and were deficient in September, but a large area was sown and the yield was sufficient for the needs of the district.

The autumn of 1908 was marked by an exceptionally severe epidemic of malaria, which hindered preparations

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for the rabi, already restricted by the drought of September. The rabi area of 1909 was therefore small, and the dry crops suffered owing to the lack of winter rains. The rains of 1909 were on the whole favourable though insufficient for late rice; the lowlands suffered from floods in July. The land was in much better condition for rabi sowings than in the two preceding years, and a large area was sown, which, with good winter rains, yielded well. The rains of 1910 were favourable until the close of September, when the crops were exceptionally promising, but rain in October led to considerable deterioration. It enabled however a full rabi area to be sown for 1911: this crop too promised to be exceptionally good, but rain in March reduced the yield of the wheat and poppy.

Progress.

There has been no permanent expansion of cropping during recent years, nor does there appear to be room for it. The area cropped fluctuates somewhat widely in accordance with the nature of the sowing seasons; and the rabi area in particular depends on the September rainfall.

There has on the whole been some improvement in the class of crops. Sugarcane shows no extension and poppy is being reduced; but on the other hand the wheat area has expanded, and there has been a marked development in the cultivation of cotton, a crop which has in the last few years become of great importance to the district. On a smaller scale two valuable crops—potatoes and tobacco—show relatively important increases.

Among food-crops recent years have seen a large decrease in the area under late rice and a marked extension of *bajra*.

The number of masonry wells has practically doubled during the last seven years, but it is still very small, there being only one well to 126 acres (as compared with 29 acres in Lucknow and 39 in Unao). The practice of sinking wells

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has not become general, but it is apparently spreading in the southern portions of the district. There has been no development of the water-supply from other sources.

The drainage of the upland tracts has been studied recently by expert engineers, and a scheme of drainage prepared: a portion of it has been carried out, and if this fulfils expectations, the completion of the project will be most desirable.

Population fell somewhat between 1891 and 1901 but the fall has been made good in the last decade: in 1911 it stood at 1,121,000 as against 1,113,000 in 1891.

Agricultural wages have not risen markedly in the last five years; the rates recorded in 1911 ranged between 2 and 2½ annas.

Advances for land improvement were taken on a large scale for a few years after the drought of 1896: then for five years practically no advances were made, but the demand was renewed in 1905 from which year till 1910 substantial sums were advanced annually. The demand now appears to be falling again. Loans for temporary purposes are taken on a small scale in ordinary seasons but a very great demand must be expected in a drought.

Agricultural co-operation has made considerable progress. In 1911 there were 124 rural credit societies with 3,778 members, financed by three central banks with an aggregate working capital of nearly 1½ lakhs. There has also been a development of urban credit societies in the town of Sandila.

The railway-system has been extended by the lines from Balamau to Sitapur and to Sandi, and is now fairly complete except for a connection with Farrukhabad, which is understood to present serious engineering difficulties. The length of metalled roads has been more than trebled in the last twenty years, and further large extensions do not appear to be required at present.

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Hardoi.

The rental statistics for the district are available only since 1903-4 owing to the interruption caused by the revision of settlement. In that year the records gave an average rate of Rs. 4·8 per acre, which has risen steadily to Rs. 5·4 in 1910-11; the rise during the last seven years has been at the rate of 1·7 per cent. annually, or nearly twice the maximum rise authorised by the Rent Act.

Weaving and such other local industries as existed have declined under stress of competition, but the co-operative movement in Sandila promises to improve the condition in that town. Industry organised on modern lines is represented by a ginning mill, and more of these are required to handle the cotton-crop, which is increasing in importance.

The district does not derive a large income from external sources: at the end of last century about 4½ lakhs was distributed annually by money-order, and the corresponding figure is now about 5½ lakhs, the increase having occurred since 1906.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of *bajra* and the late pulses, which can be sown until nearly the end of August.

The area sown with cotton is affected to some extent by the nature of the sowing season; an early start and a dry season are favourable. The chief factors determining the area are the profit obtained in recent seasons, and the relative prices of cotton and food-grains. Taking a longer view, the area is

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affected largely by facilities for marketing, and an extension would probably follow the establishment of more gins and presses.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

2. The yield of the early dry crops, of which maize is the most important, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The small area under late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

Cotton is liable to considerable injury from excessive rain: the most dangerous times are probably just after sowing, and again at the end of the season. It can withstand fairly long breaks when once it has made a fair start, and suffers from a dry September less than any other crop.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

There is not a satisfactory balance of crops in the kharif: at present something like eighty per cent. of the area under food-crops depends on the rains lasting through September, and an increase in the area under maize would be a satisfactory change though from the nature of the soil *bajra* must probably remain the staple crop.

3. The kharif crops in the lowland tracts are liable to suffer from floods on the rivers. In the Ganges lowlands the floods usually bring fertile silt, and the needs of the cultivators should be adequately met by postponement of revenue and advances for sowing rabi; but further measures will be needed both on the Ganges and on the Sai if the land is left too wet to sow rabi.

No other special causes of injury have been reported in the case of kharif crops, but insect-pests must be watched for, particularly in the case of cotton and sugarcane.

4. The rabi area depends on the rainfall in the latter half of September and the beginning of October, and a dry season may lead to a serious fall as facilities for *paleo*-irrigation are very small. The area in the lowlands may be reduced if late floods leave the land unfit for sowing.

5. In seasons when the seed-bed has been sufficiently moist, winter rains are not absolutely indispensable though within limits they are most beneficial. Falls are ordinarily valuable almost up to the end of February, provided they are moderate and of short duration: falls in March are likely to cause some injury, while prolonged periods of damp and cloudy weather in January and February will usually be followed by rust on wheat, and the full extent of the injury so caused may not be realised till the crop is harvested. Damp weather in March may result in blight on the poppy.

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Hardoi.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frosts occurring early in January are not likely to cause serious loss except to the *arhar*; late frosts, such as occurred in the first days of February 1905, may cause very great loss, particularly to the cereals.

Hailstorms do not ordinarily cause much damage until the cereals are beginning to ear; the danger from them increases as the season progresses.

Rapeseed may be seriously injured by the aphis if damp and cloudy weather occurs while the plants are in flower.

The potato crop may become infested with the potato-moth, a pest which spreads very rapidly (vide Provincial Note, section VI).

In dry seasons the young rabi crops may suffer from white ants, and field-rats may increase to such an extent that the mature crops are much injured. Both these pests are reduced by a wet season.

7. The area sown with *zaid* crops is ordinarily very small, but it may expand largely in seasons when stocks of food are low, and advances may be required to enable it to be sown.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of

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temporary wells decreases, while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, and lead to a very serious position, particularly in the *bhur* tracts and in the Sai valley, which may go almost entirely out of cultivation.

9. Distress requiring some measures of relief must be expected to occur when the rains do not last into September. Its extent will depend largely on the position of the cultivators as determined by the yield of previous harvests: it cannot be said that any portion of the district is likely to escape.

The following measures were taken in 1907-8:—

Revenue suspended, kharif	Rs. 39,000
,, ,, rabi	,, 79,000
,, remitted, kharif	,, 4½ lakhs.
,, ,, rabi	Nil.
Improvement loans	2 lakhs.
Advances for rabi	4 ,,
,, ,, kharif	2½ ,,

Maximum percentage of population requiring relief 2·5 in March.

10. A serious shortage of fodder may occur in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains: if there are none, it may become very great, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder-famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a

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sufficient size to yield fodder; but in such seasons *juar* (and possibly *bajra*) occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. The only measure that would put the water-supply of the district on a satisfactory basis is the construction of the Sarda canal. The conditions (both structural and economic) for masonry wells are so uncertain that their construction on a large scale cannot be pressed for: but persons who want to make wells should be provided with loans when required, and a sufficient staff should be maintained to enable trial-borings to be taken. In the event of a cheap and efficient percolation well being designed, arrangements should be made to provide a sufficient number to serve as demonstrations in the areas where the present supply is least satisfactory.

12. The district is perhaps more liable to suffer in a series of wet seasons than any other part of the provinces, and it is most important to recognise that the drainage works already carried out do not constitute a complete scheme of protection, but are only an experimental instalment; if they are found to succeed, no time should be lost in completing the scheme as designed, and further extensions may be found desirable.

Should the Sarda canal be undertaken, the question of drainage will immediately become urgent.

13. In order to minimise losses from cattle-disease it is most desirable that the influence of the local leaders should be enlisted in popularising the system of protective inoculation, which has not yet been accepted by the people. Attention

should also be given to ensuring prompt reporting of all outbreaks of disease in accordance with the rules laid down in the Land Records Manual; and sufficient veterinary staff should be maintained to localise outbreaks where they occur.

14. The district is not well-supplied with agricultural capital, and there are compartively few landholders who can be expected to assist their tenants in this matter. There are good prospects of a steady advance in agricultural co-operation, but for the present a wide scope exists for the *takavi*-system. Improvement loans may be wanted for the construction of masonry wells, but the chief demand is likely to be for agricultural loans, which will be required in the following circumstances:—

(*a*) *When the rains cease prematurely.*—In this case there is likely to be a very urgent demand for advances for the rabi: about February more money may be wanted for sowing sugarcane and *zaid* crops; and there will be a further demand in June for the kharif.

(*b*) *Floods in the lowlands.*—In this case advances may be required to sow rabi, and the need will probably be urgent in cases where homesteads have been destroyed or cattle lost.

(*c*) *On the occurrence of cattle-disease.*—In this case it is important to make advances available in time for cattle to be procured for the next tillage-season.

(*d*) *Curtailment of the poppy area.*—It may be desirable to offer advances in the villages where the crop has been largely grown to enable cultivators to substitute some other remunerative crop.

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15. There are good prospects of the development of the co-operative organisation as an agency for carrying out agricultural improvements requiring associated action, and no alternative agency is at present in sight. It is probable that better varieties of sugarcane, wheat and cotton can be found than those that are now grown, and that organised action can extend the cultivation of maize: there is probably scope for improved tillage-implements, especially in the low-land tracts, and also for simple labour-saving machinery, but the agriculture of the district requires detailed study before a definite programme can be framed.

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DISTRICT NOTE.

KHERI.

Topography.

THE district is divided into four tracts—trans-Gumti, Parehar, Centre and River.

The trans-Gumti tract consists of parganas Muhamdi and Pasgawan. The western portion, adjoining Shahjahanpur, lies low and is liable to injury from over-saturation; there is a fringe of sandy upland along the Gumti, but the centre of the tract is fertile loam. Proprietors are numerous and poor. Temporary wells can be made in most places except on the high banks of the rivers and ravines.

The Parehar tract lies between the Gumti and the Kathna, and includes parganas Atwa Piparia, Magdapur and Aurangabad. It is mostly high sandy land, with a belt of bad *bhur* along the Gumti. There is a low-lying swamp in the north of Aurangabad. There is practically no irrigation and apparently the sub-soil is too light for temporary wells.

The central tract lies between the Kathna and the Ul, and comprises Haidarabad, Kasta, Paila and Kheri. It is the richest part of the district, but there is poor land along the borders of the tract. The soil is mostly good loam with *bhur* along the rivers and clay in a few localities. Temporary wells can be made in Haidarabad and Kheri; in Kasta and Paila they are more difficult to make, and there is a good deal of *tál* irrigation in Paila. Kukra Mailani, which is geographically included in this tract, is, however, very inferior; there are two blocks of villages embedded in the forest, one (Mailani), high-lying loam, the other (Kukra), damp clay.

There is no irrigation and the crops suffer greatly from wild animals.

The river tract includes practically all of the district lying north and east of the Ul, parganas Srinagar, Bhur, Palia, Dhaurahra, Firozabad, Khairigarh and Nighasan. It is a wild, river-broken country, flooded in the rains, and fever is very prevalent. Wild animals do great damage to the crops, especially in the north. Cultivation shifts over wild tracts. Water is close to the surface and is uniformly bad. In a few localities as at Nighasan the land is out of the reach of floods, but the bulk of the tract is liable to be swept by the rivers. The Gogra deposits coarse, infertile sand; the Chauka and Dahawar usually give a finer deposit in which good rice can be grown, but they too bring down sand in heavy floods.

Water-supply.

The facts regarding the construction of temporary wells, the only recognised source of irrigation for the greater part of the district, have been placed on record in the well-survey. As a rule these wells are of the simplest and cheapest kind, and give a very poor supply in a dry year.

Masonry wells are little known, and in many places there is no trustworthy local tradition regarding the presence of foundation-clay: trial-borings recently made have disclosed its presence in places where it was previously unknown, but it is by no means generally met with, and boring should be done before construction is undertaken.

Cattle-supply.

The district is perhaps the most important in the provinces from this point of view, being the home of the best indigenous breeds and exporting large numbers of superior working stock. Large herds of cows well supplied with bulls are numerous: most of these are sent for grazing to Nepal. The stock of cows owned by cultivators is also very large: more bulls are required for these in many parts of the district.

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Kheri.

All the common forms of cattle-disease prevail in the district. The practice of inoculation is still regarded with suspicion by the people.

Annals.

The district was very backward when the first settlement was made, and cultivation extended steadily until 1891-92, when the area was 831,000 acres. The series of wet years from 1892 to 1895 seriously affected the low-lying tracts, while the drought of 1896 reduced the cultivated area all over the district, the area in that year falling to 716,800 acres. The district was classed in the famine as a scarcity district, distress being greatest in the trans-Gumti and Parehar tracts, which are practically a continuation of the Hardoi district. The drought, however, improved the condition of the over-saturated river tract and was followed by extension of cultivation up to 1902. The rest of the district also enjoyed favourable seasons: there was no serious loss anywhere and the cultivated area rose to close on 860,000 acres.

The yields of the seasons from 1903 onwards are given in the following table :—

Year.	Rabi.					Kharif.			
	All crops.	Wheat.	Barley.	Gram.	Linseed.	All crops.	Rice.	Small millets.	Sugar cane.
1903 ...	91	94	100	81	100	87	87	94	94
1904 ...	94	100	94	87	94	94	94	100	94
1905 ...	77	81	87	94	81	88	87	100	87
1906 ...	100	100	100	100	100	87	87	94	100
1907 ...	79	75	87	75	81	22	13	31	18
1908 ...	25	25	31	19	25	75	44	87	44
1909 ...	50	44	56	25	75	78	72	84	62
1910 ...	97	100	100	94	94	79	81	90	75
1911 ...	87	87	94	81	94	...	...	...	...

Kheri.

The year 1903 was marked by delay in the rains, and by heavy falls in October which reduced the yield of the kharif. A large area was sown for both seasons of 1904 and the year was prosperous. The exceptional frost of January and February 1905 affected the rabi crops, but the injury was serious only in parts of the south and south-west of the district, where the crops had reached the critical stage. The rains of 1905 were generally favourable but terminated rather too early for the rice and sugarcane. The rabi of 1906 was quite successful, and the following kharif was also satisfactory as a whole, though rice wanted more rain and there were floods in the north of the district. The rabi of 1907 was less successful: rain was scanty at first but excessive in February, when hail caused substantial injury, and wheat was affected by rust.

The rains of 1907 began on 21st July and ceased in August. A large kharif area was sown, but it was a failure, and in spite of the grant of advances less than half the ordinary rabi area could be sown for 1908. This crop too was largely a failure: the ground was dry and the supply of water in the wells was very scanty; the rains were deficient and early hot winds withered the crops. Relief measures began in November 1907 and continued until September 1908: the maximum percentage of the population relieved was 11·8.

The rains of 1908 began late and were in many places insufficient in September so that both rice and sugarcane were seriously injured, and a very small rabi area was again sown for 1909. This crop again was unsuccessful; rain was insufficient, and the water-level in the wells had fallen seriously while hot winds set in early. Minor measures of relief became necessary for a short time in the hot weather. The rains of 1909 were more favourable but the distribution in August was irregular: the north of the district suffered from floods while tahsil Muhamdi received insufficient rain. There was a substantial recovery in the rabi area of 1910, and at last a really good yield was secured. The rains of 1910 were at first satisfactory, but the lowland suffered severely from floods, and excessive rain in October reduced the yield of the later crops. It enabled however an unprecedented rabi area to be sown for 1911, and this crop promised exceptionally well, but its value was substantially reduced by excessive rain in March. The water-level was reported to have risen though it was still low.

Progress.

Cultivation has continued to extend and is now about 900,000 acres in favourable seasons. The rabi area is liable to very marked fluctuations. The extension of cultivation has already hampered the cattle-breeding industry, and further expansion at its expense would be by no means an unmixed benefit.

The class of cropping showed distinct improvement until 1907. The famine has resulted in a set-back, which is probably temporary, in the area under pure wheat, much the most important export crop of the district. Sugarcane is liable to marked fluctuations with the seasons, but appears on the whole to be declining. Cultivation of poppy has ceased: the crop was not grown on a large scale but was important in particular localities. No new crops appear to be extending.

There has been a relatively large increase of late years in the number of masonry wells, from 1,214 in 1906 to 1,895 in 1911, but the number is still insignificant. Construction has been most active in tahsil Nighasan and parganas Bhur and Kheri. It is impossible to say at present whether this is the beginning of a change in agricultural practice, or is merely a temporary phenomenon.

The population of the district was practically stationary between 1891 and 1901, but there has been a substantial increase in the last decade: in 1911 it stood at 959,000 as against 904,000 in 1891.

Agricultural wages have not moved appreciably in the last five years: the ordinary rate in 1911 was two annas.

Advances for land-improvement were practically unknown in the district until the last famine when large sums were distributed. A further large sum was taken in 1908-9 and smaller sums in the following years, but it is too soon to say whether the use of advances is established. Loans for temporary purposes were rarely taken until the famine when distribution was on a very large scale: 2¾ lakhs were taken in the following year, and substantial sums have been given since. A very large demand must be anticipated in any future year of drought.

There has been no development of agricultural co-operation in the district.

Railway developments in recent years have been confined to the north of the district where a line has been carried north-eastwards from Mailani through part of the river tract. In 1911 there were still only 44 miles of metalled road in the whole district, and a large increase is needed in addition to numerous bridges.

At the close of the settlement the recorded rents gave an average rate of Rs. 3·6 an acre. This rose to Rs. 4·0 between 1899 and 1902 and to Rs. 4·5 in 1906; no further rise occurred till 1910. The exact significance of these figures is doubtful, as considerable areas have been transferred from grain to cash-rents during the period: the grain-rented area stood in 1899-1900 at 293,000 acres, but in 1910-11 it had fallen to 203,000 acres despite the extension of cultivation.

The local industries are of very slight importance. Weaving, the largest, has declined. No organised industry has been established: but cane-crushing by steam power has been introduced on the estates of the Rosa Company.

The income derived from external sources is small and shows no tendency to increase: the sums distributed annually

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in money-orders since 1900 have varied from 1½ to 3½ lakhs of rupees.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be largely made good by larger sowings of rice, and also of *bajra* and the late pulses which can be sown until nearly the end of August.

The small area under transplanted rice requires frequent heavy falls of rain and little sunshine during the second month of the season.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

2. The yield of the early dry crops, chiefly kodon and maize, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

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The small area under late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather : the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains : a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

3. Apart from variations in the rainfall, the chief danger to kharif crops is from floods in the river-tract. These are expected, and they may do little harm at certain times : but assistance may be required if they destroy large areas of kharif or if they come so late as to prevent rabi sowings.

Serious injury from insect-pests has not been reported in recent years, but must be watched for, especially in the case of sugarcane.

4. The rabi area fluctuates widely : rain in early October may cause a large extension, while a dry September involves a serious reduction : facilities for irrigation are so limited that even the most liberal advances can only secure a small area.

5. When the seed-bed has been sufficiently moist, the rabi yield is not absolutely dependent on winter rains, but these are exceedingly beneficial provided the falls are moderate and of short duration and do not occur late in the season. Rain in March must be expected to cause some injury, while prolonged damp and cloudy weather between January and March is almost certain to bring on rust on wheat and linseed : the injury to these crops may be very serious, and its extent may not be fully realised until they are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall

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of winter rain is of very great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring in the early parts of January will do little harm to the crops except *arhar*. Judging by the experience of 1905 frost as late as the first days of February will cause serious damage only in the south and south-west; probably a still later frost would be very injurious, but experience is wanting.

Hailstorms do little harm until the cereals are beginning to ear; the risk of loss increases as the season advances.

The rapeseed crop may suffer severe injury from the aphis if damp and cloudy weather prevails while the plants are in flower.

7. *Zaid* crops are sown as a rule on a very small area and are not of much economic importance, but when stocks of food are low the area extends to a relatively great extent.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will probably be most noticeable in the river-tract, in the *bhur*, and in the low-lying areas of the central tract.

9. Distress requiring some measures of relief must be expected to occur when the rains have ceased by the beginning

of September: its intensity will depend largely on the position of the cultivators as determined by the yields of previous harvests. In 1907-8, when the district was severely distressed, the following relief measures were taken:—

Revenue suspended, kharif	1 lakh
" " rabi	1 "
Revenue remitted, kharif	2⅔ lakhs
" " rabi	3¼ "
Improvement loans	1½ "
Advances for rabi	5½ "
" " sugarcane	½ lakh
" " kharif	5¾ lakhs

Maximum proportion of population relieved 11·8 per cent. in March.

10. A fodder famine appears most unlikely in this district: should it occur, importation of grass from the forests can be effected more cheaply than in any other part of Oudh.

11. It is not possible at present to suggest any far-reaching measures for the improvement of the water-supply. All that can be recommended is that persons who wish to sink masonry wells should be given loans readily, and that an adequate boring staff should be maintained to assist them in locating sites and in sinking pipes where the foundation-clay lies deep.

Should a cheap form of percolation-well be designed, arrangements should be made for the construction of a sufficient number to serve as demonstrations throughout the upland tracts of the district.

The absence of any permanent water-supply makes it particularly necessary to see that all possible facilities are given for sinking temporary wells.

There may be scope for introducing irrigation pumps near some of the rivers, and every encouragement should be given to landholders who wish to take action in this direction.

12. There is at present no demand for drainage-works, but the low-lying areas should be watched carefully in the event

of wet seasons recurring. The tracts requiring observations were enumerated as follows by the settlement officer—

(i) The western portion of the trans-Gumti tract.
(ii) The north of Aurangabad.
(iii) The south of Haidarabad.
(iv) Paila.
(v) The east of Kukra Mailani.
(vi) The land along the natural drainage lines in Kasta.

13. Cattle form so large a proportion of the agricultural wealth of the district that special attention should be given to minimising losses from disease. The system of reporting laid down in the Land Records Manual should be strictly enforced, and the staff of veterinary assistants should be sufficiently strong to ensure the prompt handling of all reported outbreaks; while efforts should be made through the large landholders and other persons of influence to popularise the practice of protective inoculation.

Action is also required on lines which have still to be determined to provide better bulls in the villages where there are large numbers of cows in the hands of small owners.

The maintenance of the existing grazing areas is a matter of great importance, which has already been dealt with in government orders.

14. While some landholders are understood to finance their tenants, the district in general is not well supplied with agricultural capital, and for the present there is a wide scope for the *takavi*-system. The amount of loans required for improvements will depend mainly on the development of the taste for masonry wells: should the people decide that these are worth having, there may be a very large demand. There may also be a demand for pumping schemes. Agricultural loans may be wanted in the following cases—

(*a*) *An early cessation of the rains.*—The demand for the rabi will in this case be very great, possibly

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greater than was the case in 1907: there will be a further demand about February for planting sugarcane, and possibly for sowing *zaid* crops: and money will again be needed for the following kharif.

(b) *Floods in the lowlands.*—Advances may be needed to enable rabi to be sown.

(c) *Losses from cattle-disease.*—Advances may be wanted to replace working-stock, and it is important that they should be made available in time for the next tillage-season. There may also be scope for advances to enable owners to replace cows that have died, so as to prevent a decline in the breeding-industry.

15. There is at present no agency for the introduction of agricultural improvements requiring associated action. Some of the larger estates may possibly serve this purpose, or a co-operative organisation may develop: but for the present the scope for improvements is limited to those that can be carried out by individuals. There may be room for introducing better varieties of the crops now grown, especially wheat and sugarcane; and simple tillage-implements may be found useful particularly in the river-tract where the time for tillage is limited.

Should it prove possible to provide a permanent water-supply, the importance of the sugarcane crops may increase very greatly, and the conditions are comparatively favourable for the establishment of a sugar-industry on an extensive scale.

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DISTRICT NOTE.

FYZABAD.

Topography.

THERE are some disconnected strips of *khadir* land (known locally as *manjha*), lying along the Gogra on the north of the district; this land is exposed to annual floods and contains practically no settled cultivation. The rest of the district is upland; it is traversed from north-west to south-east by the Marha and Biswi and their continuation the Tons. The soil along these rivers, and along the high bank of the Gogra, is lighter than the rest of the district, and in places passes into sand; the remainder of the upland consists of a tract of loam varied by depressions of heavier soil.

The chief tracts of heavy soil, where rice is the prevailing crop, are:—

1. (1) the east of Khandansa, circle III, and the north-east and south-east of circle II;
2. (2) Pachchhimrath, circles II and VII, and parts of circle IV;
3. (3) Amsin, circles II(*b*) and IV;
4. (4) Majhaura, circle I and the south-west of circle III;
5. (5) Tanda, circle IV;
6. (6) Akbarpur, circle VI, and most of circle II south of the Akbarpur-Jalalpur road;
7. (7) Birhar, circle III;
8. (8) Surharpur, circle III.

The limits of these circles are given in the pargana handbooks.

Water-supply.

In ordinary seasons a very large area is irrigated in all parganas from *jhils*; when the supply in these fails increased

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use is made of existing wells, and temporary wells can be made in most parts of the district.

The chief areas where they are impossible are : (1) about one-third of Amsin, namely the land along the Gogra and Marha rivers and the Tirwa depression ; (2) nearly the whole of pargana Tanda ; (3) the light-soil villages in the east of Akbarpur.

Masonry wells can be made almost everywhere, and in most villages foundation clay is continuous, so that there is little difficulty in locating a well. There are a few villages, however, in all parganas where the clay is not continuous or lies at an excessive depth and the construction of wells is difficult. These villages have been recorded in the well-survey.

The number of masonry wells is very large, but they are very cheaply made and serve a smaller area than the more expensive wells made further south. A considerable number of villages need still more wells for security, especially in Amsin, Birhar and Akbarpur ; at the time of the well-survey it was reported that while wells would be made in many of these if capital were available, in the larger number the obstacles were either hostility or indifference on the part of certain large estates, or the internal quarrels of the large communities. The want of capital is being steadily met by improvement loans, and the other obstacles have weakened recently under the pressure of drought ; but in pargana Birhar the divergent interests of owners still constitute a serious obstacle.

Drainage

The areas where defective drainage has been noticed are as follows :—

(1) Kola and its vicinity in Mangalsi.

(2) The centre of Haveli (Oudh).

(3) The Tirwa depression in Amsin.

(4) The southern parts of Tanda and Birhar.

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(5) The west centre, south-west and extreme south-east of Pachchhimrath.
(6) The north centre of Khandansa.
(7) The south centre of Akbarpur.
(8) The north of Majhaura.
(9) The north-east of Surharpur.

In addition the valleys of the Tons and its tributaries are liable to suffer from moving floods in years of exceptional rainfall. Most of the areas noted above could be drained only into the Tons system: but this system is already overburthened, and drainage of Fyzabad would aggravate the injury that occurs on its lower course unless that also could be improved. There appears however to be room for improving the channels of the Tirwa and Tanuri streams, which flow direct into the Gogra.

Cattle supply.

The stock of cows in the district is relatively small and their quality inferior: there are sufficient bulls. There are practically no grazing areas except in a few places along the Gogra, and there are no larger herds of cows, nor is the stock concentrated in particular localities. The cows give little milk and much of what they yield is taken for consumption or for *ghi* making, so that the calves are inadequately nourished. Working-cattle are imported mainly from the districts to the north and north-west.

The district has in the past suffered from rinderpest, but there have been few outbreaks in recent years. Other diseases are common, particularly foot-and-mouth disease. The practice of inoculation is now welcomed by the people.

Annals.

The early reports received throw little light on the agricultural history of the district; it is known that the wet years ending with 1894, caused a good deal of loss to the people, but the areas specially affected are not on record. The older revenue reports show that a wet cold weather has usually been followed by rust, and that rinderpest has caused serious loss in cycles of wet years.

In 1896 the failure of the rains caused much loss and the district was for relief purposes classed as a scarcity district: the kharif was less than forty per cent. of a normal crop, but the rabi was much better and the distress disappeared rapidly. From 1897 to 1902 the district was almost uniformly prosperous, the only calamities being the rust on wheat in 1901, and in the same year considerable injury to the rice crop in most of tahsil Tanda and the east of Akbarpur owing to local deficiency in the rainfall.

The seasonal yields since 1903 are given in the following table:—

Year.	Rabi.					Kharif.			
	All crops.	Wheat.	Gram.	Peas.	Poppy.	All crops.	Rice.	Small millets.	Sugarcane.
1903 ...	89	100	88	88	100	62	65	25	95
1904 ...	77	87	56	87	94	100	87	100	87
1905 ...	73	81	75	69	75	75	75	75	100
1906 ...	83	81	87	75	100	77	78	80	94
1907 ...	79	69	87	87	75	26	16	50	35
1908 ...	75	94	31	75	50	66	50	95	44
1909 ...	69	81	31	56	87	94	97	94	62
1910 ...	98	100	94	100	87	87	84	94	94
1911 ...	96	94	100	94	87	...	...	...	...

The rains of 1903 were late and were inadequate in July but excessive in September and October. A very large area was sown for the ensuing rabi, when most crops did fairly well, but gram was seriously injured by caterpillars. The rains of 1904 were good and a final fall in October enabled a full rabi area to be sown for 1905. The exceptional frost of this year did comparatively little harm except to peas, but wheat and linseed suffered from rust and rape-seed from the aphis. The following rains were excessive in August and September,

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while the rabi of 1906 was slightly injured by rain in February. The rains of this year were at first excessive and there was some flooding in July, but August and September were too dry for the later crops and the rabi area of 1907 was somewhat reduced. This crop was affected by wet weather in February, and wheat suffered from rust.

The rains of 1907 failed in September and the late rice was lost while all other crops suffered severely. Sugarcane was also attacked by the cane-hopper. The rabi area was greatly contracted and while cereals yielded well gram and poppy were very poor. There was some distress in the cold weather and regular relief works were started: the distress practically disappeared with the rabi harvest. The following rains were light and in September quite insufficient: rice was consequently a poor crop, as was sugarcane which suffered from cane-hoppers as well as from drought. The land was in many places too dry for sowing rabi and some of the shallow wells failed: the rabi area of 1909 was consequently much below normal, and as there were practically no winter rains the unirrigated crops were very poor. The rains of 1909 were favourable, lasting from the beginning of June to the end of September, and the only poor crop was sugarcane, which was again attacked by cane-hoppers. The rabi area of 1910 showed a substantial increase though still below normal and the crops did well, while the following monsoon was favourable and its prolongation into October secured a very large rabi area for 1911. This crop suffered somewhat from rain in March, but the yield was in all cases good.

Progress.

There has been no appreciable extension of cultivation in recent years and there is probably no room for further expansion. The proportion of land devoted to remunerative crops has not altered materially in the last two decades: wheat has extended during this period, but sugarcane has declined and indigo has fallen seriously though in 1911 it was still grown on

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about 4,000 acres. Among food crops maize has extended rapidly during recent years, while early rice and small millets have displaced late rice.

The number of masonry wells increased by eight per cent. between 1907 and 1911, and in the latter year there was one such well to 20 acres of normal cultivation: this is a very high proportion, but it must be remembered that the wells can serve a smaller area than is the case further south, and protection is by no means complete. A project has been prepared for a canal along the north of the district to be fed by water pumped from the Gogra, but no decision on it has yet been taken.

Population increased very slightly between 1891 and 1901, but has fallen considerably in the last decade; in 1911 it stood as 1,154,000 as against 1,207,000 in 1891.

Agricultural wages, which are still largely paid in grain, have not risen during the last five years; in 1911 the highest rate recorded was two annas, and rates ranged as low as 1¼ anna.

Advances for land improvement were taken with fair regularity from 1897 to 1906, but the aggregates were small. In 1907-8 loans were taken on a large scale, and over half a lakh has been advanced in the last three years. Loans for temporary purposes were also taken regularly for small aggregates, but between 1907 and 1909 the advances were very large, and the demand during the last two years has been considerable. There has thus been an apparent increase in the popularity of the system.

Agricultural co-operation has made a satisfactory start: in 1911 there were 41 rural credit societies with about 1,000 members, financed by the district bank. There were also 24 urban credit societies, mainly among the weavers of Tanda.

The railway system has been extended during the last twenty years by the opening of the line to Allahabad, while a branch from Akbarpur to Tanda is under construction: in 1911 there was one station to 115 square miles. Some extensions

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of metalled roads have been made, mainly as railway feeders, and a considerable number of these is still required.

The upward movement of rents has been steady: in 1896 when the records were resumed after settlement the recorded rents gave a rate of Rs. 5·2 per acre and in 1911 this had risen to Rs. 6·0.

The chief industry of the district is weaving which with subsidiary crafts—centres in Tanda. While not so extensive as it was a century ago, the industry has been fairly maintained in recent years. Sugar refining has somewhat declined under competition, and the amount of seasonal occupation afforded by indigo factories has been greatly reduced. Modern industries are represented only by a small flour mill recently started.

The district derives a substantial income from outside its borders: in the last three years about 24½ lakhs have been distributed annually by money-orders, while in the famine year 1907-8, the aggregate exceeded 45 lakhs. The increase in the amount distributed has been rapid, as between 1898 and 1900 the average was about 14 lakhs only.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be reduced and rice will extend.

Late rice, which is of diminishing importance requires frequent falls of rain and little sunshine during the planting season, which usually coincides with the second month of the rains, and the area will be reduced by a long break at this period.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One

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of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

2. The yield of the early dry crops, chiefly kodon and maize, depends mainly on the weather during the first two months of the season; alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best. Rice and kodon are very frequently sown mixed in order to average the season. The late dry crops, which are of much less importance here than further west, require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

3. Apart from variations in the rainfall, the following dangers exist in the kharif season:—

(*a*) Floods on the Tons and its tributaries may cause severe loss within a limited area, and the need may arise for postponement of the revenue and for advances to sow the rabi. Similar measures may possibly be required in the areas of defective drainage enumerated above.

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(*b*) Sugarcane may be seriously injured by the cane-hopper (vide Provincial Note, section VI).

4. The rabi area depends on the amount of rain received in September and early October: drought at this period will lead to a marked reduction, but the position is less unfavourable than north Oudh because of the facilities for *paleo*-irrigation provided by the masonry wells.

5. In seasons when the seed-bed has been sufficiently moist, the rabi is not entirely dependent on the winter rains as the large irrigated area can give a full yield. Rain is beneficial up to the latter half of January, provided the falls are moderate and of short duration: rain from February onwards will probably cause some injury, while prolonged periods of damp and cloudy weather in January and February must be expected to produce rust on wheat and linseed; the extent of the injury from this cause may not be fully realized till the crops are harvested. The poppy crop is liable to serious injury from blight if damp and cloudy weather continue late in the season.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case; a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

Frost early in January causes little damage except to *arhar*. Late frosts are to be dreaded. That which occurred in the opening days of February 1905 did comparatively little harm except to peas, and probably the danger is greatest in this district about 20th to 25th of January.

Hailstorms do little harm until the cereals are beginning to ear; the risk increases as the season advances.

The rapeseed crop may be seriously injured by the aphis if damp and cloudy weather occurs when the plants are in flower.

7. The *zaid* area is small in ordinary seasons, but increases to a moderate extent when stocks of food have been depleted as the result of a drought. In such seasons advances may be desirable to enable an extended area to be sown.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. The lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts, as occurred sporadically in the spring of 1909.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen almost throughout the district, and may be overlooked for a time, but the collection of the revenue will require careful study when wet seasons set in.

9. Distress requiring some measures of relief must be expected if the rains cease by the beginning of September, but the high proportion of the area under early crops makes the district less dependent on September rainfall than in the case in most parts of the provinces. The following relief measures were taken in 1907-8:

Revenue suspended, kharif	2⅓ lakhs.
" " rabi	Rs. 1,000
Revenue remitted kharif	1⅙ lakh.
" " rabi	Rs. 17,000
Improvement loans	¾ lakh.
Advances for rabi	3¼ lakhs.
Advances for kharif	1¼ lakh.

Maximum proportion of the population relieved 3 per cent. in February.

10. The district grows a comparatively small area of the late millets, and their failure does not make a very material difference in the fodder-supply. The conditions under which

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such a shortage of fodder as to require government action may occur cannot be learnt from experience, and apparently the contingency is very unlikely. Should it arise the only measure that can be taken is importation of grass from the forests to the north.

11. The development of the system of masonry wells is the most important measure for the improvement of the water-supply. The offer of loans for construction should continue on the present lines, and the efforts which the district administration has been making to remove social obstacles should not be relaxed.

The projected canal from the Gogra is agriculturally most desirable, if it can be carried out as a productive work.

There may be room for extending the system of embankments in the rice-tracts (vide Provincial Note, section III).

12. There is no present demand for drainage works, but the areas of defective drainage enumerated above will require careful watching if wet seasons recur, and should receive special attention in any investigation that may be made of the drainage of the Ganges-Gogra doab.

13. The most important steps to be taken in order to minimize loss from cattle disease are the strict enforcement of the system of reporting prescribed in the Land Records Manual, and the maintenance of a veterinary staff sufficient to ensure the prompt treatment of all outbreaks of disease.

14. The supply of agricultural capital is quite inadequate. There are good prospects that it may be substantially increased by the extension of the co-operative organization, but for the present the *takavi*-system is essential and should be generously worked. Improvement loans are wanted for masonry wells, and possibly for embankments. Agricultural loans will be wanted in the following circumstances:—

(*a*) *An early cessation of the rains.* Very large sums can be lent with advantage for the rabi: there may be a further demand about February for sugarcane and *zaid* crops: and more will be wanted in June for the kharif.

(*b*) *Floods.* Vide paragraph 3 above.

(*c*) *Cattle disease.* Advances to replace losses should be made available in time for the next tillage season.

(*d*) *Curtailment of the poppy area.* If this step is taken, it may be desirable to offer advances in villages where a large area has been grown in order to enable the cultivators to substitute some other remunerative crop.

15. Conditions on the bulk of the large estates are probably at the present time unfavourable for the introduction of agricultural improvements requiring associated action, and the co-operative organization is the most hopeful agency. The position of the cultivators indicates that the most probable line of advance is the introduction of improved methods, or new staples or varieties, not requiring large capital outlay; the cropping of the district requires to be examined before specific recommendations can be made.

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DISTRICT NOTE.

GONDA.

Topography.

THE district falls into three natural divisions, the *tarai*, the *uparhar*, and the *tarhar*.

The tarai *or submontane tract.*—This tract includes Tulsipur and Balrampur with the third and fourth assessment circles of Utraula. The two first-named parganas are almost entirely held in permanent settlement by the Maharaja of Balrampur. The tract is bounded on the north by the line of forest under the hills, and it extends southwards across the Rapti. The villages immediately along this river are of light, fertile soil, which is frequently renewed by the rich silt: the rest of the tract is mainly clay and yields excellent rice, but it is unhealthy and subject to heavy floods.

The uparhar *or uplands.*—This tract lies south of the *tarai* and includes the central portion of the district, viz. the whole of parganas Mankapur, Sadullanagar, Burhâpar and Babhnipair, most of Gonda (circles I—IV) and Utraula (circles I and II), and parts of Nawabganj (circle III) and Mahadewa (circle IV and some villages of circles II and III). It is intersected by a number of small rivers, which flow between deep banks and are bordered by belts of high land, covered with a thick growth of trees and rough bushes and difficult to reclaim or not worth reclaiming. The rivers thus divide up the tract into sections of level fertile land separated by uneven spaces of poorer quality. The soil is mainly loam and is productive: irrigation is easy in most places as wells and *jhils* are numerous, and unprotected wells can be easily dug; there is little loss from flooding; and the hindrances to production that exist are due to the character of the people rather

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than to the land. The southern edge of the uplands is sandy and in places uneven.

There are two large forests in the tract. One lies along the bank of the Kuana and affects the first circle of Gonda. The other, a government forest known as Tikri, affects Mankapur (circle III), Mahadewa (circle IV), Nawabganj (circle III), and the western edge of Babhnipair. The villages in their neighbourhood may suffer greatly from wild animals.

The tarhar *or Gogra lowland.*—This tract lies between the ***uparhar*** and the river Gogra, and includes Paharapur, Gwarich, Digsar, the bulk of Nawabganj (circles I, II and IV), and Mahadewa (circle IV and parts of II and III), and the fifth and sixth circles of Gonda. It is a lowlying tract with a subsoil of pure sand covered by a loam deposit of varying depth, and its fertility depends entirely on this deposit. As a rule the land is easily worked and requires little irrigation, yielding particularly well in dry seasons; but the tract is liable to destructive inundations in years of heavy rainfall, and floods are apt to be followed by sickness. A part of this tract, comprising the third circle of Digsar and the third and part of the fourth circle of Gwarich, lies lower than the rest, and suffers almost every year from floods. The villages exposed to the direct action of the Gogra are grouped in the fourth circle of Digsar and Nawabganj and the fifth circle of Gwarich: the course of the river is by no means fixed, and cultivation on its banks is highly speculative.

Water-supply.

In the *tarai* there is little irrigation, beyond the application of surface water to the rice fields. The *tarhar* does not ordinarily need irrigation, but temporary wells can be made in most parts, and the extensive lakes and swamps are largely used when the need arises. These sources are also important in the upland tract, but there wells are the principal source. Temporary wells can be made cheaply in most parts of the tract, but there are a few localities (recorded in detail in the

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well survey) where they cannot be made. The number of masonry wells is very large: the great majority of them appear to depend on percolation and they are made at very small cost. Local information regarding the presence of foundation-clay is very imperfect because the people are not accustomed to sink wells to the spring: it is certainly not generally present, and probably it is absent from most parts of the district. When the well-survey was made the district authorities considered that there was very little scope for increasing the number of masonry wells: but construction was very active during the famine of 1908 and the number available continues to increase: the cost of construction is so low that it is probably sound business to make a masonry well instead of digging a temporary one whenever wanted.

Cattle-supply.

The stock of cows in the district is relatively large, and is concentrated to some extent along the Gogra but mainly in the *tarai* tract, where grazing is available in the government and private forests. The cows are not as a rule owned in large herds: they are an inferior type of the submontane race, and the young stock suffer from the fact that a large proportion of the milk is used for making *ghi*. The supply of sacred bulls appears to be adequate. Superior working cattle are imported from Bahraich and Kheri.

Foot-and-mouth disease and haemorrhagic sapticaemia are common diseases in the district. There has been comparatively little rinderpest in recent years, but losses from this cause have been very heavy in the past. The people are now fully alive to the advantages of preventive inoculation.

Annals.

There are few records of severe calamities before 1894-95 when the series of regular reports begins. The famine of 1873-74 was felt in the district and relief works were required in the *tarai*, but in 1877-78 distress was slight and local; and the remaining records relate to floods in the *tarhar*. Such

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floods occurred in 1893 and 1894; while in 1895 the rabi was poor all over the district owing to the excessive wetness of the season. It is probable, though the fact was not reported, that part of the injury was caused by rust on wheat. The injury caused by wild animals in the neighbourhood of the Tikri forest became more and more serious from 1893 onwards, and the abolition of the forest was at one time contemplated, but it was decided to postpone action in this direction and to take measures to reduce the number of wild animals and half-wild cattle.

In 1896, the loss of the kharif was great in the *tarai* and considerable in the *uparhar*, but the *tarhar* gave a heavy yield of maize; the rabi of 1897 was fair, and though Gonda was classed as a "scarcity district" for relief purposes the distress was never acute and the recovery was rapid.

In 1901 the prolonged damp weather led to a severe outbreak of rust on wheat, and in the following season the rain was insufficient for late rice; but no other calamities were reported between 1897 and 1902, and in the latter year it was recorded that the country near the Tikri forest showed marked and sustained improvement as a result of the measures taken to reduce the number of half-wild cattle.

The seasonal yields since 1903 are given in the following table:—

Year.	Rabi.						Kharif.			
	All crops.	Wheat.	Gram.	Linseed.	Rapeseed.	Poppy.	All crops.	Rice.	Maize.	Sugarcane.
1903 ...	94	100	88	100	100	88	72	75	62	100
1904 ...	96	94	94	100	100	81	87	94	75	75
1905 ...	73	75	81	62	62	75	85	94	56	100
1906 ...	97	100	94	75	75	100	81	81	75	100
1907 ...	76	75	75	75	75	75	17	6	25	55
1908 ...	37	50	16	50	50	33	77	50	100	81
1909 ...	77	81	62	62	100	44	87	87	81	69
1910 ...	98	100	94	87	87	84	82	84	75	94
1911 ...	97	94	100	94	94	81	...	...	...	...

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Gonda.

In 1903 the rains began late but were heavy, and the lowlands were flooded, while maize yielded very badly. Good rain in October secured the largest rabi area on record for 1904, and the yield was good. The following rains were too heavy for maize but suitable to rice. The rabi of 1905 was less satisfactory: the exceptional frosts of this season did comparatively little damage, but wheat and linseed suffered from rust and rapeseed from the aphis. The rains were marked by heavy floods in the lowlands and much injury to maize by excessive rain in August. The following rabi was good except in the case of oilseeds.

The rains of 1906 were at first too heavy for maize and later too light for rice: there were again heavy floods in the lowlands. The following rabi was only a moderate crop owing to rain and damp weather in February and March. In 1907 the rains began late, were weak throughout, and practically ceased in August: much of the kharif failed entirely, while the rabi area of 1908 was 50—little more than half of the normal. The rabi yield was bad as the crops suffered from drought in the early stages and were unable to resist the hot winds of March. During these seasons distress was severe particularly in the *tarai* tract: relief operations began in December; works were closed when the rains arrived but gratuitous relief was continued until September.

The rains of 1908 set in early and the season was favourable to the early crops, but September was too dry for rice, which yielded badly, and the rabi area of 1909 was still much below the normal. The season was unfavourable to gram, oilseeds and poppy, but other crops did fairly well. The following monsoon began early and lasted well: there were however heavy floods in the lowlands. The rabi area of 1910 was still below the normal but the season was favourable. The monsoon of this year was marked by heavy rain in August and October and a deficiency in September. Floods were

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again extensive and maize suffered in August. The October rain secured a very large rabi area for 1911: poppy was affected by blight but all other crops were good.

Progress.

There has been no material extension of cultivation during the last two decades. The proportion of land devoted to remunerative crops is fairly high and tending to increase owing to the extension of wheat, the great rabi staple of the district. Sugarcane has lost ground in recent years, and the area under poppy has been somewhat reduced. The area under oilseeds varies greatly with the seasons but has on the whole been maintained.

Satisfactory statistics of masonry wells are available only since 1907. The number has increased by about 4,000 in four years, owing chiefly to activity in construction during the famine. In 1911 there was one such well to 35 acres of normal cultivation, a high figure when allowance is made for the area where wells are not used.

The population of the district fell substantially between 1891 and 1901, but there has been a slight recovery during the past decade: in 1911 it stood at 1,412,000 as against 1,459,000 in 1891.

Agricultural wages have shown a slight tendency to advance in the last five years; the highest common rate recorded in 1911 was 2¼ annas, but probably the average remuneration is substantially less than two annas, and rates as low as 1¼ annas are still found.

Advances for land improvement were unknown until 1907, with the exception of some special advances made during the famine of 1896-97. In 1907-08 however two lakhs were advanced under this head: and two years later Rs. 6,000 were taken, but in 1910-11 practically nothing was advanced, and it cannot be said that the practice is established.

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Advances for temporary purposes are taken only in adverse seasons: in 1907-08 they reached the great sum of 22½ lakhs, and there can be very little doubt that advances on the same scale will be wanted should a similar season occur.

There has as yet been no regular propaganda in the interests of agricultural co-operation, but in 1911 seven rural credit societies existed with about 500 members.

The railway system has been substantially extended during the last twenty years. During this period the main line of the Bengal and North-Western Railway was extended westwards from Gonda and eventually carried across the Gogra, while a branch was constructed northwards to Tulsipur and subsequently extended to Uska in Basti. In 1911 there was one station to 123 square miles, as compared with 206 square miles in 1891. Progress has also been made in metalling the more important roads but much remains to be done in this respect and also in the provision of bridges.

Rents are not at present rising rapidly. The records for 1903-04 (the first prepared after settlement) give a rate of Rs. 4·7 per acre, and by 1910-11 this had risen only to Rs. 4·9. Rents are kept down by the large proportion of high caste tenants, who ordinarily enjoy a preference of about 25 per cent. and who are not submissive in the matter of enhancements.

The only considerable industry of the district—hand-loom weaving—has declined under stress of competition, and no modern forms of industry have yet been introduced. The district however derives a considerable and increasing income from employment outside its boundaries: the sums distributed by money-order have averaged about 11½ lakhs annually since the famine, as against 6 to 8 lakhs in the years at the end of the last century.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting

from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of rice.

The area under late rice depends mainly on the weather during the second month: there should be frequent falls and not much sunshine, and the area will be reduced by a long break at this time.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

2. The yield of the early dry crops depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain and is not likely to give a full yield when the dry crops do best.

The late dry crops, which are little sown, require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The

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second is the end of the rains : a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

The conditions of the district are such that a uniformly bad or uniformly good kharif is a rare phenomenon. The *tarhar* wants light rain for the first two months and the rest of the season is almost immaterial. The *tarai* wants light rain at first, but heavy rain from August to October, while the *uparhar* does best with a moderate rainfall distributed throughout the season.

3. Apart from variations in the rainfall, the chief factor affecting the kharif yield is the period and extent of the floods in the *tarhar*. Maize is the chief crop in this tract : it yields very heavily if it ripens before the floods come, but is liable to entire destruction if the land is flooded while it is growing.

Serious injury from insect-pests has not been reported, but should be watched for, especially in the case of sugarcane.

4. The rabi area depends on the amount of rain received in September and end of October. Heavy rain in October enables extensive sowings to be made after rice : while an early cessation of the rains involves a very large curtailment, which however can be to some extent mitigated by the grant of advances.

5. In seasons when the seed-bed has been sufficiently moist, the rabi yield does not depend entirely on winter rains, but these are very beneficial within due limits. Rain up to the end of January is useful provided the falls are moderate and of short duration : rain from the middle of February onwards is likely to cause some injury : while prolonged periods of damp and cloudy weather in January and February must be expected to produce rust on wheat and linseed. The extent of the injury caused by this disease may not be fully realised until the crops are harvested.

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When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring early in January does little harm: late frosts may cause very serious injury to the cereals, but experience does not indicate the period of greatest danger: the frost that occurred in the first days of February 1905 did not cause great injury, and probably the danger is greatest about the 25th of January.

Hailstorms early in the season cause little injury, but the danger increases as the season progresses.

The rapeseed crop is liable to serious injury from the aphis if the weather is damp and cloudy when the plants are in flower.

The poppy crop suffers severely from damp weather late in the season.

7. The area sown with *zaid* crops in ordinary seasons is not large, but it expands considerably in seasons when stocks of food have been reduced: loans may be required for sowing it when seasons have been unfavourable.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts, though this occurrence has not so far been recorded.

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Gonda.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will probably be most noticeable in the *tarai*, which will become more unhealthy from the same cause.

9. The country in the neighbourood of the Tikri forest has suffered greatly in the past from wild and half-wild animals; the present conditions are fairly satisfactory, but careful attention should be given to any complaints, which may indicate that the number of wild animals has been allowed to increase.

10. Distress requiring some measures of relief must be expected to occur when the rains have ceased by the beginning of September: it will probably be most severe in the *tarai* tract. The following measures were taken in 1907-08, when distress was very severe.

Revenue suspended, kharif	6½	lakhs.
" " rabi	4⅓	"
" remitted kharif	2	"
" " rabi	⅓	lakh.
Improvement loans	2	lakhs.
Advances for rabi	10½	"
" " kharif	12	"

Maximum proportion of population relieved 12·0 per cent. in March.

11. Experience does not indicate any conditions in which a serious shortage of fodder is likely to occur. The area under the late millets is so small that even their entire loss is immaterial.

12. As regards the improvement of the water-supply there does not appear to be much scope for action beyond ensuring a supply of capital when required for wells or for embankments (see Provincial Note, section III) in the rice-tracts. Should a cheap percolation well be designed, arrangements should be made for the construction of a sufficient number to serve as demonstrations in the tracts that depend on percolation for their supply.

13. There appears to be no need for drainage-works, and certainly no demand for them has been expressed in recent years.

14. In order to mitigate losses from cattle-disease, it is most important to secure prompt reports of outbreaks under the system prescribed in the Land Records Manual, and to maintain a sufficient veterinary staff to prevent outbreaks from spreading.

The maintenance of the existing private forests is important in the interest of owners of cows.

15. The district is not rich in agricultural capital, and the conditions on some of the large estates are such that the landholder cannot be expected to finance his tenants. A co-operative organisation may develop, but for the present the *takavi*-system is indispensable. Improvement loans are not likely to be taken on a large sçale, but they should be given when wanted for masonry wells or for embankments.

Agricultural loans may be required in the following cases:—

(*a*) *Early cessation of the rains.*—The demand for both rabi and kharif may be very large, while money may also be wanted about February for sugarcane and *zaid* sowings.

(*b*) *Floods in the* tarhar.—Advances may be required to secure rabi sowings.

(*c*) *Cattle disease.*—Advances should be made available to enable cultivators to replace their working-cattle in time for the next tillage-season.

(*d*) *Curtailment of the poppy area.*—Advances may be needed in villages where the crop has been largely grown to enable cultivators to substitute some other remunerative crop.

16. It is possible that the management of some of the large estates may be able to introduce agricultural improvements

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requiring associated action, but the most hopeful agency for this purpose is a development of the co-operative organisation. There is probably scope for introducing improved varieties of the crops now grown, and for introducing new crops, but the produce of the district needs examination from this point of view. Labour is still very cheap, and there is not much scope for machinery except on the larger holdings, but simple tillage implements would probably be useful, particularly in the *tarhar* tract, where it is most important to save time. The district appears to present a relatively favourable field for the development of an organised sugar industry.

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DISTRICT NOTE.

BAHRAICH.

Topography.

THIS district may be divided into four tracts, the Gogra tract, the central uplands, the Rapti tract, and the trans-Rapti tract.

The Gogra tract.—This tract lies between the Gogra on the west and the Sarju on the east; it includes the whole of Hisampur, Fakhrpur and Dharmanpur, half Nanpara (circles I—V), and small portions of Bahraich (circles IV and V) and Ikauna (circle I). The limits of the assessment circles are shown in the handbooks. Down to the neighbourhood of Nanpara the Sarju on the east is a large and active river; at that point it has cut across or been diverted into the Gogra, and beyond this point its old bed is a more or less swampy channel.

This tract is lowlying and irrigation is unusually unnecessary: small wells can be made if required. Most of the tract is exposed to floods: the injury is usually greatest along the course of the Gogra and along the old bed of the Sarju: the intervening country lies rather higher and suffers less. The injury is serious only in abnormally wet years.

The silt brought down by the Sarju is ordinarily fertile, but that of the Gogra is usually coarse, infertile sand. The fifth assessment circle in Nanpara differs from the rest, resembling more nearly the trans-Rapti tract; the soil is stiff clay and transplanted rice is the principal crop.

Central uplands.—This tract includes nearly all Bahraich (circles I—III), half of Ikauna (circles II—IV), half of Nanpara (circles VI—IX), and three-fifths of Charda (circles

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I and II and block I of the permanently-settled villages). It is good loam or clay with very little sand. In ordinary years a single watering is sufficient for the rabi, and is given from the numerous small tanks and in a few places from temporary wells. There are very few masonry wells, and as temporary wells can be made only here and there the rabi suffers to some extent in years of light rainfall. The tract is well drained and in no danger from flood.

Rapti tract.—This tract is composed of a small part of Ikauna (circle V), five-sevenths of Bhinga (circles I—III), and two-fifths of Charda (circles III and IV and block II of the permanently-settled villages). It is, as a rule, fairly good land along the river and irrigation is unnecessary. Floods occur frequently in wet seasons, but the silt brought down is fertile and gives good rabi crops.

Trans-Rapti tract.—This includes pargana Tulsipur, a small part of Ikauna (circle VI), and two-sevenths of Bhinga (circles IV and V). The tract is of the *tarai* type; the soil is mostly heavy clay and in many villages transplanted rice is the principal staple. Irrigation is not needed in ordinary years: when, however, the rains cease early water is needed for the rice; streams and swamps are utilised but more protection would be of great value if it could be supplied. The tract is reported not to suffer seriously from flooding.

Water-supply.

The available sources of irrigation have been indicated above. Substantial numbers of masonry wells are shown in the statistics for the Gogra and upland tracts, but they are as a rule little used, being mainly for domestic supply. Local information as to the existence of foundation-clay cannot be relied on; it apparently exists here and there, but is not general. The local officers who examined the results of the well-survey considered that there was very little scope for the profitable construction of masonry wells; some were made during

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and just after the famine, but the rate of construction has slackened.

On the other hand large numbers of temporary wells are required in dry seasons; about 10,000 such wells are made in ordinary years but there were close on 40,000 in 1907-8. The localities where they can be made are indicated in the well survey.

Cattle-supply.

The stock of cows in the district is very large, and it is concentrated towards the north where a large amount of grazing is available in government and private forests. Large herds such as are found in Kheri are not numerous, small herds of 50 to 100 cows being the rule. The special breeds recognised are the Nanpara and Risia, but the former is being gradually displaced by animals of the superior Khairigarh type. The number and quality of bulls appears to be sufficient. The district exports large numbers of plough-cattle, chiefly to south Oudh and the Gorakhpur division. Extension of cultivation has reduced the grazing areas which are now, it is understood, fully occupied, and further expansion will tend to reduce the production of cattle.

The district is liable to all the ordinary forms of cattle-disease. The practice of inoculation is now welcomed by the people.

Annals.

Few calamities were recorded in the district before the series of regular reports began. There was distress requiring relief in the north of the district in 1874 and again in 1878, when the rice crops had been lost owing to drought, but it was not serious or prolonged.

During the wet seasons ending in 1894 the Gogra tract suffered a good deal from excessive moisture and cultivation declined temporarily. In 1896 the only serious injury was the loss of the transplanted rice, and there was no general distress. Rabi sowings for 1897 were restricted owing to the

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want of moisture. In 1899 again there was a certain amount of loss to the transplanted rice, principally in the trans-Rapti tract; some attempt was made to protect part of this tract by constructing tanks, but the Deputy Commissioner did not think that very much could be done. Attention was this year drawn to the unhealthiness of this tract.

In 1900 the transplanted rice again suffered, and in the following year wheat was reported to have been very disappointing; probably this was due to rust which was severe in neighbouring districts in the same season. About this time cultivation was steadily on the increase.

The seasonal yields since 1903 are given in the following table:—

Year.	Rabi.					Kharif.		
	All crops.	Wheat.	Gram.	Linseed.	Rapeseed.	All crops.	Rice.	Maize
1903 ...	88	94	88	94	94	83	81	87
1904 ...	90	94	87	94	94	87	90	87
1905 ...	75	81	69	44	81	81	87	69
1906 ...	85	81	87	81	87	68	75	50
1907 ...	78	75	75	81	94	22	13	25
1908 ...	31	31	19	25	25	84	56	100
1909 ...	55	56	31	62	77	78	78	75
1910 ...	95	94	94	94	94	91	94	87
1911 ...	98	94	100	106	94	...	...	...

The rains of 1903 began late but were heavy, and the falls in October damaged the later crops, but enabled the people to sow the largest rabi area on record for 1904. This year was prosperous apart from floods in the lowlands, and a full rabi was sown for 1905. The exceptional frosts of February caused little injury except to *arhar*, but rust affected wheat and particularly linseed. The rains of 1905 were at first heavy and injured maize, while they were deficient in

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September, and the rabi area of 1906 was reduced. The following rains were marked by exceptionally severe floods in July and August, and by a deficiency of rain later on which injured late rice. The rabi of 1907 suffered from untimely rain and hailstorms, and wheat was attacked by rust.

The rains of 1907 began late, and were inadequate throughout, so that most of the crops were lost and only a small rabi area could be sown for 1908. Although there was good rain in January, the moisture in the soil was never sufficient for the spring crops which dried up rapidly under the high west winds of March. During these seasons distress was severe and widespread relief measures were continued till the end of August as the rabi brought little amelioration. The early kharif of 1908 did well, but the latter part of the season was too dry for rice which yielded very badly in tahsils Bahraich and Nanpara. The rabi area of 1909 was again much restricted, and the crops suffered in the same way though to a less extent than in the previous year. Relief measures on a small scale were required from April to August.

The rains of 1909 began early and were at first copious, causing very extensive floods in the lowlands. They were again locally deficient in September but the late rice was saved by a fall at the beginning of October. The rabi area of 1910 showed a marked rise though it was still below the normal, and the winter rains were favourable. The following monsoon was also satisfactory though the lowlands again suffered from floods; and the very large rabi area sown for 1911 yielded well despite some injury from rain in March.

Progress.

The area cultivated continued to expand up to 1906 when it exceeded one million acres: it has practically returned to this standard after the temporary decrease due to drought. The proportion devoted to remunerative crops has distinctly risen during the last decade: sugarcane, which is little grown, is not increasing and poppy has been reduced, but wheat the chief staple shows a steady advance.

There has been no effective development of facilities for irrigation though a few localities have been benefited by the construction of masonry wells.

The population of the district increased substantially between 1891 and 1901, but there has been a slight decrease in the last decade; in 1911 it stood at 1,048,000 as against 1,000,000, in 1891.

Agricultural wages have risen somewhat in the last five years; in 1911 the rate of 2½ annas was not uncommon, but much lower rates, ranging down to 1¼ annas, also prevailed.

Advances for land improvement were practically unknown in the district until 1907: in the three years ending in 1910 approximately one lakh of rupees was distributed, but the demand has fallen away, and there does not appear to be any general tendency to borrow for masonry wells. Advances for temporary purposes are well known, as they are regularly offered after floods to enable the people to sow rabi. Between 1907 and 1909 these advances aggregated 21 lakhs, and a large demand may be anticipated in future adverse seasons. There has been practically no development of agricultural co-operation in this district, where propaganda has not yet been started; in 1911 a single rural credit society existed with about 200 members.

The railway system has been extended during the last 20 years by the opening of the line from Nanpara to Katarnianghat in the extreme north-west of the district, and also by the completion of the Bengal and North-Western Railway main line, which traverses the southern corner. In 1911 there was one station to 177 square miles as against 335 square miles in 1891: but the real improvement has been greater than these figures show as the construction of the Elgin bridge brought

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the district into more direct touch with a large part of India, and there has been a remarkable development of trade.

The scarcity of *kankar* in the district has retarded the metalling of roads : twenty years ago there were only small stretches aggregating 11 miles ; in 1911 there were 31 miles in all, but large additions are needed.

Rents have risen steadily since settlement. The rents recorded in 1898 gave a rate of Rs. 4·2 per acre, and in 1911 the corresponding rate was Rs. 4·9, the same rate as in Gonda and slightly above the rate for Kheri.

The only local industry of any importance is weaving : it has declined here as elsewhere. The district contains no factory in the modern sense of the term. The income derived from external sources is very much less in Bahraich than in any other district of the division : distribution by money-order averaged from 1½ to 2 lakhs annually at the end of the last century, while the present average is about 3¼ lakhs.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of rice.

The area under late rice depends mainly on the weather of the second month, when there should be frequent falls of rain and little sunshine; a long break at this period will reduce the area.

2. The yield of the early dry crops depends mainly on the weather during the first two months of the season :

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alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops, which form only a small proportion of the total require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The late rice, which is most important in the north-east of the district, requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

The chief defect in the balance of cropping is the extent to which the trans-Rapti tract depends on late rice.

3. Apart from variations in the rainfall, the main factor in the kharif yield is the flooding of the Gogra tract. Maize is very largely grown in this tract, and yields heavily: but it is very quickly destroyed by floods, which occur almost every year, and the question is usually whether the floods come before or after the maize has been harvested.

Serious injury from insect-pests has not been recorded, but should be watched for.

4. The rabi area depends on the amount of rain in September and early October. If this period is altogether dry a heavy fall must be expected, while on the other hand rain in October secures a considerable extension.

5. In seasons when the seed-bed has been sufficiently moist, the rabi yield is not entirely dependent on the occurrence of winter rains, though these are very beneficial within due limits. Falls occurring up to the beginning of February are valuable provided they are moderate in amount and of short duration: falls after the middle of February will usually

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cause some loss: while prolonged damp and cloudy weather in January and February must be expected to produce rust on wheat and linseed. The loss from rust may be very serious, and its full extent may not be realized till the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frosts occurring early in January cause little injury except to the *arhar*. Late frosts may be very injurious, but experience is wanting to show the most dangerous time.

Hailstorms do little harm until the cereals are beginning to ear; the danger from them increases as the season advances.

The rapeseed crop may be seriously injured by the aphis if the weather is damp and cloudy when the plants are in flower.

The poppy crop suffers severely from damp weather late in the season.

7. The area sown with *zaid* crops in ordinary seasons is very small: it increases when stocks of food are low, but is of importance in at most a few localities.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will probably be most noticeable in the Gogra tract. The trans-Rapti tract may be similarly affected, and in any case is likely to become more unhealthy.

9. Early attention should be given to any complaints that the injury caused by wild animals is extending, as the effect of extension is cumulative: and if land near the forests is found to be going out of cultivation endeavours should be made to arrange with the Forest department, or the owners, for a restoration of the balance.

10. Distress requiring some measures of relief must be expected to occur when the rains have ceased by the beginning of September: it should not be severe if July and August have been normal, in which case it will probably be almost confined to the trans-Rapti tract, but it may be severe and general after a season like 1907 when the rains did not last long enough for even the early crops to mature. The following measures were taken in 1907-8:—

Revenue suspended, kharif ...	... ¾	lakh.
„ „ rabi ...	... 2½	lakhs.
„ remitted, kharif ...	... 1½	lakh.
„ „ rabi ...	... 2	lakhs.
Improvement loans	... ⅓	lakh.
Advances for rabi ...	... 2¼	lakhs.
„ „ kharif ...	... 10	„

Maximum proportion of population relieved 24·8 per cent. in March.

11. Experience does not indicate any conditions in which the shortage of fodder may be so serious as to call for action by Government: the area under the large millets is so small that even their entire failure would not affect the district as a whole.

12. The improvement of the water-supply is a difficult question. In the trans-Rapti tract there may be scope for embankments to benefit the late rice (vide Provincial Note, section III): the Gogra and Rapti tracts may be left out of

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account, though it is possible that pumps on the latter river might be useful in places; the central upland must depend mainly on wells. This tract is a continuation of the upland tract in Gonda where cheap masonry wells are used in large and increasing numbers, and no explanation is known of the reason why there are so few in Bahraich. The divergence should be studied by the agricultural department before definite recommendations are made; but in the meantime facilities should be given to any one who wishes to make a well—both in the way of loans and by provision of a boring-staff to locate sites.

13. No demand for drainage works exists at the present time. The settlement officer was of opinion that much could be done to improve the drainage of parts of the Gogra and Rapti tracts, and this question should be studied in the light of the remarks contained in the settlement report when a qualified engineer can be obtained.

14. Cattle form a large proportion of the agricultural wealth of the district, and their protection from disease is a matter of great importance. The chief measures are insistence on prompt reporting of disease under the system prescribed in the Land Records Manual, and the maintenance of a veterinary staff sufficient to prevent outbreaks from spreading.

The maintenance of the pasturage provided by the private forests is a matter of importance.

15. The district is not well supplied with agricultural capital, and pending the development of alternative sources the *takavi*-system should be liberally worked. There is not at present a large demand for improvement loans, but they may be wanted for wells and for embankments. Agricultural loans may be wanted in the following circumstances:—

(*a*) *Early cessation of the rains.* The demand may be very large both for the rabi and for the following

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kharif: small sums may also be wanted about February in particular localities to enable sugarcane and *zaid* crops to be grown.

(*b*) *Floods in the lowlands.* Advances may be required to enable the rabi to be sown.

(*c*) *Cattle disease.* Advances may be required to enable cultivators to replace their working-cattle in time for the next tillage-season. The needs of owners of cows should also be considered, in order to minimize the set-back to the breeding-industry.

(*d*) *Curtailment of the poppy area.* It may be desirable to offer advances in villages where the crop has been largely grown to enable cultivators to substitute some other remunerative crop.

16. Some of the large estates may be able to co-operate effectively in the introduction of agricultural improvements requiring associated action, but should a co-operative organisation develop it will furnish a more useful agency. The varieties of the crops grown can probably in some cases be replaced, and new crops be introduced, but study is required before specific recommendations can be made. There is not much scope for machinery, except on a few of the larger holdings; but simple improved tillage-improvements would probably be useful, specially in the lowlands.

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DISTRICT NOTE.

SULTANPUR.

Topography.

THE district may be divided into three tracts, the lines of division running roughly parallel to the Gumti which flows from north-east to south-west. Along the river the prevailing soil is loam while further north and south is rice country with *jhils* and *usar* plains.

Northern clay.—This tract occupies the north and east of Aldemau, and extends to a narrow strip of land on the north of Baraunsa and Isauli. It depends very largely on late rice so that an early cessation of the rains causes an almost entire loss of the principal crop. The drainage of this tract is sufficient in ordinary years, but when the rainfall has been excessive there is much flooding, which injures both the kharif and the rabi. The Majhui river, which flows along the northern boundary, floods its banks in such seasons.

Gumti tract.—This tract includes practically the whole of Jagdispur, the greater portion of Isauli, Musafirkhana, Miranpur, Baraunsa and Chanda, and the south-west of Aldemau. There is some *tarai* land on the river especially from the centre of Jagdispur to Isauli town and again in the north of Miranpur. This land is very productive in ordinary years, but when a heavy flood occurs on the Gumti it gets waterlogged, *reh* appears, and cultivation is rendered impossible till a dry year enables it to recover. The banks of the river are a good deal broken by ravines and the land is at first very sandy; further inland it is a level, fertile loam till it passes into the clay tract. The drainage of this tract is good, and the only part likely to suffer from wet is the *tarai* already mentioned.

Southern clay.—This tract includes the whole of Gaura, Jamun and Amethi, nearly the whole of Asal, and the west of Musafirkhana and Miranpur. It is heavy soil, full of *jhils* with large *usar* plains: late rice is an important crop. In wet years the whole tract is liable to injury from floods which affect the kharif directly and may leave the land in bad condition for the following rabi: but the people are not anxious for drains, fearing their effect in dry seasons.

Water-supply.

Much irrigation is done from *jhils* in all parts of the district, the proportion being highest in Aldemau: wells are however the most important source. Masonry spring wells can be made almost everywhere except along the Gumti where foundation-clay is not met with, and a few villages in other parganas which have been recorded in the well-survey: masonry wells are popular with cultivators, but a certain amount of hostility on the part of landholders was recorded especially in pargana Baraunsa.

The district officials who carried out the well-survey considered that there was scope for more wells in nearly 400 villages, mainly in pargana Asal and in the river tract. Temporary wells can be made in most parts of the district: the villages where they will be required in a drought are recorded in the well-survey. Ordinarily they are cheap and do not last beyond a single season, but in some localities they remain efficient for many years.

Cattle-supply.

The stock of cows is relatively very low and the quality inferior: there are no extensive grazing grounds, and no herds of any size; the cows are kept for milk, and the calves are insufficiently nourished. Working cattle are imported from north Oudh and also from Bundelkhand.

The district is liable to all the common forms of cattle disease, and there have in the past been very heavy losses from rinderpest. The practice of preventive inoculation is now welcomed by the people.

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Sultanpur.

Annals.

The first reports received show that from 1892 to 1894 the district had a succession of poor crops, the result mainly of excessive rainfall. In 1894 there was a great flood on the Gumti which completely destroyed the fertility of the *tarai*, and in the same year much of the late rice was destroyed by excessive floods in the lowest parts of the clay tracts. In 1896 the rains ceased in August; most of the kharif suffered severely and the late rice was almost a complete failure. There was some distress but a considerable area was sown with rabi which gave good yield, and further relief was obtained from the hot-weather *sawan* which was sown on a large scale. The harvests of the following year were good and the distress disappeared rapidly; the dry season cured the *tarai* which came under cultivation again, and also indirectly benefited the whole district which had been more or less soaked by the run of wet years. From 1897 to 1900 no serious calamity visited the district; cultivation recovered, and the people were, generally speaking prosperous. In 1901 prolonged damp weather caused serious rust on wheat and barley, while the rains were at first so scanty as to injure early rice. The year 1902 was prosperous.

The seasonal yields since 1903 are given in the following table :—

Year.	Rabi.				Kharif.				
	All crops.	Wheat.	Barley.	Gram.	All crops.	Rice.	Small millets.	Pulses.	Sugarcane.
1903 ...	89	100	100	81	76	84	85	44	81
1904 ...	81	87	87	69	94	84	100	87	87
1905 ...	35	31	31	50	79	75	100	75	100
1906 ...	83	87	87	87	72	65	95	75	100
1907 ...	71	50	87	75	20	13	35	13	55
1908 ...	75	87	87	50	59	31	85	75	52
1909 ...	65	62	75	44	88	84	100	94	59
1910 ...	96	94	100	94	83	87	100	62	94
1911 ...	82	75	87	87	...	...	...	...	...

Sultanpur.

In 1903 the rains were late and at first scanty; heavy falls in October injured all the later crops, but enabled a very large rabi to be sown for 1904: this crop did well with the exception of gram which was seriously injured by caterpillars. The rains of 1904 were favourable though not quite sufficient for the rice crop, and they lasted sufficiently long to ensure another very large rabi area in 1905. The crops promised well till the exceptional frosts of February which caused very great injury especially to cereals. The following rains were good at first but deficient late in the season; and the rabi area of 1906 was reduced owing partly to drought and partly to the want of sound seed, which was not available locally owing to the frost of the previous year.

The rains of 1906 were favourable to the early crops but deficient in August and September, and the following rabi suffered from rain and cloudy weather in February and March, wheat in particular being affected by rust. The rains of 1907 were late and scanty, and ceased prematurely: all crops suffered very severely, and sugarcane was affected by the cane-hopper as well as by drought. The rabi area of 1908 was reduced by more than one-fourth and the crops—especially gram—suffered from want of moisture in the early stages of growth. There was some distress during these seasons, but it was never severe and it diminished rapidly when the rabi was harvested. Some works were open from January to April, while gratuitous relief continued till July.

The following monsoon was light throughout and especially in September so that the rice crop was very poor. Sugarcane was again seriously damaged by cane-hoppers. The rabi area of 1909 was again much contracted, and there was much difficulty in irrigating as the *jhils* were dry. The rains were however favourable though a final fall in October would have improved the late rice; the injury caused by cane-hoppers was very marked in this year. The rabi area of 1910 was extended though still below the normal, and the season was favourable

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throughout. The rains were too light for rice in July and August: heavy falls at the end of September injured the late crops other than rice: but the yields were on the whole satisfactory, and the cane-hopper was rarely seen. A very large rabi area was sown for 1911; the crops were somewhat affected by prolonged damp in March, wheat suffering most.

Progress.

A slight increase in cultivation occurred between the close of the settlement in 1897 and 1902: the area has been practically constant during the last decade and there appears to be no room for further expansion. The proportion of land devoted to remunerative crops is low and shows no increase. Wheat has increased slightly but sugarcane has fallen and indigo is now little grown. The poppy area had increased slightly, but is now falling. Among food crops maize has extended considerably of late years, the area having more than doubled since 1907.

The number of masonry wells increased by 22 per cent. between 1905 and 1911, in which year there was one such well to 26 acres of normal cultivation; construction was naturally most rapid during the famine, but has been well maintained since.

Population increased very slightly between 1891 and 1901, while there has been a substantial fall during the last decade: in 1911 it stood at 1,048,000 as against 1,076,000 in 1891.

Agricultural wages have not moved appreciably in the last five years; in 1911 the prevailing cash rate was two annas, while the grain rates were equivalent to cash rates, lying between 1½ and 2 annas.

Advances for land improvement were taken on a small scale between 1897 and 1906, the amount ranging from Rs. 250 to Rs. 2,000 in ordinary years. During the famine large sums were advanced, and half a lakh was taken in

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1908-9; the demand has since decreased. Loans for temporary purposes are taken on a moderate scale in ordinary seasons, but the demand appears to have increased substantially since the famine.

Agricultural co-operation appears to be well established in the district. In 1911 there were 48 rural credit societies with over 1,200 members, financed by three central banks, and expansion is going on rapidly. In the same year there were eighteen small societies, established with the special object of providing sound seed for their members.

Communications have greatly improved. In 1891 the district was practically without railways, though the loop line of the Oudh and Rohilkhand Railway just touched it on the extreme east: the main line now serves the south-west, and the Fyzabad branch passes through the centre. The number of stations is still below the standard of the province, there being only 1 to 245 square miles. Metalled roads have been increased by close on 100 miles during the same period, but further extensions are still required.

Rents have risen fairly rapidly since the conclusion of the settlement. Between 1898 and 1900 the recorded rents gave a rate of about Rs. 5·9 per acre, while for 1909—1911 the rate is Rs. 6·6, and it appears to be rising steadily.

Industries are exceptionally unimportant in the district; hand weaving has never been widely extended, but has suffered from competition: there is little sugar refining, while a small amount of seasonal employment has been lost by the closing of indigo factories. No factory of the modern type exists in the district.

Income from external sources, mainly service outside the district, forms a most important resource, and has increased rapidly. Between 1898 and 1902 the sums distributed by money-order were about 14 lakhs annually, but from 1905 to 1907 over 19 lakhs were received; in 1907-8, the famine year,

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the sum rose to 22 lakhs, and in the last two years it has exceeded 24 lakhs, or four-fifths of the recorded rental of the district.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed but early rice will extend.

The area under late rice, which is important in both the clay tracts, depends mainly on the weather of the second month: frequent falls of rain and little sunshine are desirable, and a long break may reduce the area considerably.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

2. The yield of the early dry crops, which are rapidly increasing in importance, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

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The late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain but prolonged breaks are likely to cause injury.

In the past the cropping of the district was badly balanced, with excessive dependence on rain in September; the balance is being redressed by the increasing popularity of maize, but a further extension of this crop is desirable.

3. Apart from variations in the rainfall, the chief danger to the kharif is flooding in the lowlands, but this occurs to a dangerous extent only in very exceptional seasons.

The sugarcane may be injured very seriously by cane-hoppers (vide Provincial Note, section VI); and probably both cane and *juar* are liable to injury from boring insects.

4. The rabi area depends mainly on the rainfall of September and October. Rain in the latter month secures a large extension of a second crop on rice land; when the rains cease early the rabi area must fall, but the fall can be mitigated by the timely grant of advances.

5. The irrigation facilities are so great that when the seed-bed has been sufficiently moist the rabi yield depends relatively little on the occurrence of winter rains: these are however beneficial up to the latter part of January provided the falls are moderate in amount and of short duration. Later rain will usually cause some injury, while prolonged periods of damp and cloudy weather in January and February must be expected to produce rust on wheat and linseed, and possibly on barley also; in this case the full extent of the loss may not be realised until the crops are harvested.

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When however the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frosts occurring in the early part of January will do little harm except to the *arhar*: late frosts however may cause very serious injury, especially to the cereals and peas: probably the most dangerous time is just at the end of January or in the first days of February, when the frosts of 1905 took place.

Hailstorms cause little injury until the cereals are beginning to ear; the danger increases from them as the season advances.

The rapeseed crop suffers much injury from the aphis if damp and cloudy weather occurs when the plants are in flower.

Gram has in the past suffered from caterpillars, but the conditions under which this danger arises are not actually known.

Poppy suffers from blight if the latter portion of the season is damp.

7. The *zaid* area is of some importance in ordinary seasons and expands rapidly when stocks of food have been reduced, the hot-weather millet known in Oudh as *sawan* being the chief staple. The cost of seed of this crop rises very high when the demand is great, and advances would probably be welcomed about February in seasons when the kharif yield has been bad or the rabi is unpromising.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficien-

rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts; and any reports that the wells are failing should receive special attention.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, its effects will be most noticeable in the small lowland areas along the Gumti which may go out of cultivation, but the gradual impoverishment of the uplands is perhaps a more serious danger.

9. Distress requiring measures of relief must be expected to occur if the rains cease at the beginning of September; its extent will depend largely on the position of cultivators as determined by the yield of previous harvests. The following measures were taken in 1907-8, when the distress was relatively slight :—

Revenue suspended, kharif	Rs. 86,000
„ rabi	„ 10,000
Revenue remitted, kharif	3¾ lakhs.
„ rabi	Nil.
Improvement loans	1¼ „
Loans for rabi	3 „
„ „ kharif	2 „

Maximum proportion of the population relieved 3 per cent. in February.

10. A serious shortage of fodder may occur in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth : in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains; if there are none, it may become very great, but even light

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falls bring up enough grass to keep large numbers of cattle going.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons *juar* occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. There is still room for a large number of masonry wells, and loans for their construction should be readily given, while endeavour should be made to influence any landholders who still throw obstacles in the way of construction.

There may also be scope for action in regard to embankments in rice tracts (vide Provincial Note, section III).

12. There is no demand for drainage works at the present time, but the clay tracts which suffer from flooding should receive careful attention in any examination that may be made of the Ganges-Gogra doab.

13. In order to mitigate losses from cattle disease, attention should be given to securing prompt reports of outbreaks, under the rules laid down in the Land Records Manual; and the local veterinary staff should be sufficiently strong to localise outbreaks when they occur.

14. The district is not well supplied with agricultural capital and the extension of the co-operative movement is most desirable. For the present however there is a wide scope for the *takavi*-system. Improvement loans may be wanted mainly for wells and embankments. Agricultural loans are likely to be wanted in the following conditions:—

(*a*) *Early cessation of the rains.*—Advances may be required on a large scale to sow the rabi, and their early distribution is a matter of the utmost

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importance. Smaller sums may be required towards February for sugarcane and *zaid* crops; and a further large demand may be expected in June for the kharif. Advances may also be required to buy fodder.

(*b*) *Floods.*—In the exceptional years when floods cause much damage, loans may be required for sowing the rabi.

(*c*) *Cattle disease.*—It is desirable to make loans available to replace working cattle before the next tillage season begins.

(*d*) *Curtailment of the poppy area.* Advances may be desirable in the villages where it has been largely grown to enable cultivators to substitute some other remunerative crop.

15. Conditions on the large estates are not as a rule favourable at present for the introduction of agricultural improvements requiring associated action, and the development of the co-operative organisation is probably the most hopeful line of action. The district does not offer much scope for improvements requiring large capital outlay, though there may be a demand for pumping installations on the larger *jhils*. There is probably room for a great improvement in seed stocks and for introducing new staples; and a demand may be expected to arise gradually for the cheapest forms of improved tillage implements.

DISTRICT NOTE.

PARTABGARH.

Topography.

THE topography of this district is generally similar to that of Rae Bareli. On the south-west, where the Ganges touches parganas Manikpur and Bihar, there is a stretch of *kachhar* or *tarai* land: most of this is sandy and unproductive, but there are fertile areas in places. Above this is a strip of fertile loam, occupying the centre of Manikpur and the greater part of Bihar. Then follows a tract of stiffer soil, full of *jhils* and imperfectly drained, covering the north-east of Manikpur and Bihar, the whole of Dhingwas, the greater part of Rampur and the south of Partabgarh and Patti. Further north again is the Sai tract, lighter loam shading off into *bhur*; this covers the north of Rampur, nearly the whole of Ateha, most of Partabgarh and the south centre of Patti. Finally the greater part of pargana Patti, north of the Sai is again stiff soil, full of *jhils* and badly drained.

Tarai *tract.*—The chief feature of the *tarai* is an area of stiff soil near Benti which has been reclaimed by extensive engineering works. Elsewhere the crops are liable to injury in wet years. The uncultivated area is of some value for grazing.

Ganges loam tract.—The Ganges loam tract is a rich fertile soil except where broken by ravines. Irrigation is adequate as there are many masonry wells, and good temporary wells can be made almost everywhere. The drainage is also good.

Jhil *tract.*—The soil is usually stiff, with clay in the depressions, and much rice is grown: but light sandy soil is often found above the *jhils*. In ordinary seasons the *jhils* furnish an ample supply of water for the rabi; but when the rains have ceased early the supply falls short, and as the sub-soil is sandy in many places temporary wells cannot be made to the extent that is required. In wet years the drainage is altogether inadequate and the tract suffers from waterlogging: the injury is greatest in the villages lying close to the *jhils*. A main drain has been constructed to benefit the southern part of Patti, but other projects are not contemplated.

Sai tract.—The Sai tract is mainly light fertile loam, with sand in places along the river and its tributary streams; but the country is a good deal broken up by extensive systems of ravines. The level portions of the tract are admirably protected by wells of both kinds, and temporary wells can be dug almost everywhere. In the broken country along the river temporary wells cannot be made, and some villages suffer in consequence in dry years. The tract is thoroughly drained, and injury in wet years is confined to the small tracts of lowlying land along the Sai.

Patti clay tract.—The Patti clay tract is largely irrigated from *jhils* in ordinary years, but temporary wells can be made in most places on the level ground when the supply in the *jhils* runs short. The drainage is very defective, and in wet seasons most of the tract suffers from floods and water-logging. On the extreme east where the Gumti touches the pargana there are a few villages with lighter soil resembling the Sai tract.

Water-supply.

The chief sources of irrigation have been noticed above. Masonry wells are possible practically throughout the district except along the Sai, Gumti and Ganges where foundation-clay is not commonly met with. These wells are exceedingly popular with cultivators and very little hostility on the part of landholders exists. In some villages however construction has

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been impeded by quarrels among pattidars. In the opinion of the district authorities who examined the well-survey there was still need for many more masonry wells in all parganas except Rampur and Dhingwas. The villages where temporary wells cannot be made have been recorded in the well-survey: there is room for large numbers of these in a dry season.

Cattle-supply.

The stock of cows in the district is very small: there are no large grazing areas, and the cows are not concentrated in herds, but are kept by individuals for the sake of their milk. The supply of bulls is sufficient for the cows. The quality of cows and young stock is inferior. The better working cattle are imported from north Oudh, while large numbers of inferior animals come from the Bundelkhand breeding grounds.

The district is liable to all the ordinary forms of cattle disease: rinderpest appears usually to be imported from Bundelkhand *via* the lower doab. The people were at first strongly opposed to the idea of preventive inoculation, but their attitude has altered and the practice will probably be accepted in time.

Annals.

There are few records of serious calamities before the series of annual reports began. There was distress in 1878 following on the drought of the previous year, but the demand for relief was not large and recovery was rapid. The district suffered from the wet seasons ending in 1894, especially the last when excessive rain flooded the lowlying parts and damaged both the standing kharif and the following rabi. In 1895 the rain was scanty and the kharif suffered while the rabi area of 1896 was short and was affected by the absence of water in the *jhils*. The rains of 1896 ceased in August, the rice crop was almost a total failure, and other crops also suffered severely. The kharif yield as a whole was less than 40 per cent. of the normal, while the rabi area of 1897 was much reduced. For relief purposes the district was classed as "scarcity":

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relief works attracted some labourers in the spring but were not required after the rabi, which yielded well, was harvested. The years from 1898 onwards were prosperous until 1901 when there was widespread rust on wheat. The rains of 1901 were late and there were breaks which injured the rice, and in the following year rice and sugarcane were affected by want of rain in August.

The seasonal yields since 1903 are given in the following table :—

Year.	Rabi.				Kharif.				
	All crops.	Wheat.	Barley.	Gram.	All crops.	Rice.	Juar.	Small millets.	Sugarcane.
1903 ...	88	88	88	75	76	90	70	75	81
1904 ...	85	81	87	80	87	84	95	100	75
1905 ...	36	34	34	50	85	85	80	95	87
1906 ...	100	94	100	100	81	81	75	100	100
1907 ...	81	81	87	85	43	22	45	65	75
1908 ...	78	81	83	55	75	56	80	95	56
1909 ...	81	81	81	75	90	94	67	94	79
1910 ...	100	98	100	100	77	94	44	90	97
1911 ...	84	75	79	100	...	...	...	...	...

The rains of 1903 began very late but were heavy and lasted into October when the late dry crops were injured. A very large rabi area was sown for 1904. The following rains were deficient at times for rice, but again enabled a large rabi to be sown for 1905. The exceptional frosts of February were disastrous in this district. A large *zaid* area was sown, and the following kharif was much the largest on record : the rains were favourable until September when they were deficient, and the rabi area of 1906 was much reduced. It yielded exceptionally well, but local damage from hail was severe. The rains that followed were sufficient except for rice and

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secured a normal rabi area for 1907: the yield was reduced by prolonged damp weather in February and March.

The rains of 1907 began fairly well but ceased at the end of August; most of the rice was lost and all other crops suffered. The rabi area of 1908 was naturally contracted, but was larger than could have been expected, and the crops yielded fairly well with the exception of gram. No direct measures of relief were required during these seasons, but revenue was suspended and considerable sums given in advances. In 1908 the rains were light, and a long break in September almost ruined the late rice. The rabi area of 1909 was low owing partly to the drought and partly to the prevalence of fever, while there was little water in the *jhils*.

The rains of 1909 began early and were favourable, but sugarcane was injured by the cane-hopper and *juar* by the hopper and by borers. A normal rabi area was sown for 1910 and yielded exceptionally well. The following monsoon was light at first but very heavy in September, when *juar* and *bajra* suffered serious injury. The late rain gave a large rabi area for 1911: the pulses were good but the cereals suffered from excessive rain in March.

Progress.

There was a slight apparent extension of cultivation after the completion of the settlement, but the last decade shows no further progress, and there is practically no room for further expansion. The proportion of the land devoted to remunerative crops has been steady with perhaps a slight tendency to fall. Wheat has not expanded: sugarcane has varied greatly from year to year but has not extended on the whole: indigo has disappeared, and poppy has been reduced. San hemp has extended substantially, and an export trade in the fibre has developed since the railway was opened, and on a small scale potatoes and garden crops have increased in importance. Among food grains maize has been very little grown, but the area has doubled in the last four years and the crop is apparently becoming popular—an important point as the district is at present too dependent on September rain.

Construction of masonry wells has proceeded actively, and the number available increased by 2,730 between 1905 and 1911: in the latter year there was one such well to 24 acres of normal cultivation as against 27 acres in the former.

The population of the district has remained almost unchanged during the last two decades; in 1911 it stood at 900,000 as against 911,000 in 1891. The ratio of population to normal cultivation is the highest of any rural district in Oudh.

Agricultural wages do not appear to have risen in the last five years: the rates recorded in 1911 lay between 1½ and two annas.

Advances for land improvement (mainly wells) have been a regular feature in this district, the annual amounts given ranging until 1907 between Rs. 2,000 and Rs. 4,000. In the famine year however, advances were very largely taken, and over half a lakh has been given during the last two years. Advances for temporary purposes have also in the past been regularly taken on a small scale: but the demand has apparently increased considerably since the famine.

A beginning has been made in the introduction of agricultural co-operation. In 1911 there were 14 rural credit societies with over 1,000 members. Reorganisation is in progress, and a large expansion of the movement is anticipated.

There has been very marked improvement in the means of communication. Twenty years ago the district was quite unserved by railways, Allahabad being then the nearest station to Partabgarh. The opening of the Oudh and Rohilkhand main line, of the branches to Allahabad and Fyzabad, and more recently the Allahabad-Rae Bareli line, has provided

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ample communications for the district, and in 1911 there was one station to 111 square miles. In the same period the mileage of metalled roads has risen from 45 to 120, and further improvements are contemplated.

The rise in rents since settlement has been steady : in 1895 the recorded rents gave a rate of Rs. 6·2, which had risen to Rs. 7·0 in 1910 and 1911.

There are no important industries in the district. Some sugar is refined in tahsil Patti, but this industry has suffered from competition, as has the unimportant handloom industry ; and the closing of indigo factories has involved the loss of seasonal employment. There is no factory in the modern sense of the word.

The district derives an income of growing importance from external sources, the people of all classes being habituated to the idea of seeking employment in other parts of India. At the end of the last century about ten lakhs of rupees were distributed annually by money-order : while in the last two years the figures have exceeded 17 lakhs, or considerably more than the revenue of the district.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowings to proceed without interruption. If the first month is wet, sowings of dry crops will be reduced, but rice will extend, and there will probably be larger sowings of *bajra*, which can be sown until nearly the end of August.

The area under late rice depends on the weather during the second month : frequent falls of rain with little sunshine are required, and a long break will reduce the area substantially.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvests.

2. The yield of the early dry crops depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

The cropping is not altogether well-balanced; the district depends too much on the late crops, and an extension of early crops, and especially maize, is desirable. Judging from recent figures this extension is in progress.

3. The kharif crops are also exposed to the following dangers:—

(a) Floods in the *tarai* and the clay tracts in exceptionally wet seasons,

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(*b*) The cane-hopper) vide Provincial Note, section VI).

(*c*) Boring insects in sugarcane and *juar* (vide Provincial Note, section VI).

4. The rabi area depends mainly on the rainfall during September and early October. A heavy fall of rain in October results in an area much above the normal : while if the rains cease by the beginning of September there will be a serious reduction in area, which can however be mitigated by the early grant of advances.

5. Irrigation facilities are so great that the occurrence of winter rains is not essential in seasons when the seed-bed has been sufficiently moist. Falls up to nearly the end of January are however beneficial provided they are moderate in amount and of short duration : later falls will probably cause some injury, while prolonged periods of damp and cloudy weather in January and February must be expected to produce rust on wheat and linseed, and possibly also on barley. The loss from rust may be very serious, and its extent may not be fully realised till the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case : a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring early in January does little harm except to the *arhar*. Late frosts may cause very serious loss : probably the period of greatest danger is the last few days of January and the first few days of February.

Hailstorms early in the season do little harm, but the danger increases as the season advances.

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The rapeseed crop is liable to severe injury from the aphis if damp and cloudy weather occurs while the plants are in flower.

The gram crop is occasionally injured severely by caterpillars: the conditions under which this occurs are not yet accurately known.

The poppy suffers severely when damp and cloudy weather occur late in the season.

Where potatoes are grown, a watch should be kept for the potato moth (vide Provincial Note, section VI), which may cause very serious losses.

7. A substantial area is sown in ordinary seasons with *zaid* crops, principally the hot weather millet known in Oudh as *sawan*; and the area increases largely when stocks of food are low. The cost of seed of *sawan* rises very high when a large demand sets in and it may be desirable to offer advances for its purchase when the kharif yield has been bad or the rabi is unpromising.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts, but this is not known to have occurred.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will probably be most noticeable in the clay tracts and in the small lowlying areas on the Sai.

Another process with cumulative results is the extension of the ravine systems along the Sai and its tributaries (vide Provincial Note, section V).

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Partabgarh.

9. Distress requiring some measures of relief must be expected to occur when the rains have ceased at the beginning of September. In 1907-8 no direct relief was found necessary, but the following measures were taken :—

Revenue suspended, kharif	2 lakhs.
,, ,, rabi	Rs. 27,000
Revenue remitted : kharif	,, 33,000
,, ,, rabi	Nil
Improvement loans	1 lakh.
Advances for rabi	1½ lakhs.
,, ,, kharif	1½ ,,

10. A serious shortage of fodder may occur in seasons when the rains have ceased so early that the large millets wither altogether or are seriously stunted in growth : in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains : if there are none, it may become very great, but even light falls bring up enough grass to keep large numbers of cattle going.

A fodder famine does not necessarily occur when the millets yield no grain, as the plants may have grown to a sufficient size to yield fodder ; but in such seasons *juar* occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods : the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. The most important action for the improvement of the water-supply is the provision of facilities for the construction of masonry wells, which are still required in considerable numbers. The chief need is the continuance of the present policy of giving loans, but a boring staff should also be maintained for some time to come, to locate sites in the doubtful

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villages and also to pierce the foundation-clay where it is too thick for the tools ordinarily available.

There may also be scope for improvement in the matter of embankments in rice country (vide Provincial Note, section III).

12. There is at present no demand for drainage works: but both the *jhil* tract and the Patti clay are badly drained, and they should be watched in wet seasons, while they should receive special attention in any investigation of the drainage of the Ganges-Gogra doab.

13. In order to minimise losses from cattle disease it is important to pay continuous attention to the enforcement of the rules for reporting outbreaks contained in the Land Records Manual, and also to maintain a veterinary staff sufficient to localise outbreaks when they occur. Efforts should also be made to influence public opinion in favour of the practice of preventive inoculation.

14. Cultivators on a few of the large estates are supplied with capital by the landholders, and there is a hopeful prospect of the development of the co-operative organisation, but at the present time the supply of agricultural capital is insufficient, and the *takavi*-system should be liberally worked. Improvement loans are wanted mainly for masonry wells, and to a less extent for embankments in rice tracts. Agricultural loans may be wanted on the following occasions:—

(*a*) *Early cessation of the rains.*—Advances may be wanted on a large scale first for sowing the rabi and again for the following kharif: while smaller sums may be required about February for sugarcane and *zaid* crops, and during the cold weather to buy fodder.

(*b*) *Floods.*—In exceptional years advances may be needed to enable the rabi to be sown.

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(c) *Cattle disease.*—It is important that cultivators should be in a position to replace working-cattle before the next tillage season begins.

(d) *Curtailment of the poppy area.*—Advances may be needed in villages where the crop has been largely grown to enable the cultivators to substitute some other remunerative crop.

15. It is possible that agricultural improvements requiring associated action might be introduced through the management of one or two of the larger estates, but should the co-operative organisation develop, as is expected, it will offer a more satisfactory agency. There is probably considerable scope for improving seed stocks, notably of wheat and sugarcane for accelerating the extension of maize; and for introducing any new crops that may be found suitable to the soil and climate provided they require the labour of the family rather than extensive capital outlay. The scope for expensive agricultural machinery is probably small at present, though a demand may arise for power-pumps for the *jhils*, but the cheapest forms of improved tillage-implements will probably come gradually into favour.

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DISTRICT NOTE.

BARA BANKI.

Topography.

THE district may be divided into three tracts which may be named after the rivers which affect them—the Gogra Chauka *khadir*, the Kaliani tract, and the Gumti tract; but the transition between the second and third is gradual.

The Gogra Chauka khadir.—The *khadir* is wide on the north-west but narrows towards the east. It includes the whole of Bhitauli, practically the whole of Mohammadpur and Bado Sarai, about half of Ramnagar, part of Daryabad, and a small portion of Rudauli. Bhitauli lies between the Gogra and the Chauka and resembles the *ganjar* tract in Sitapur; it is swept by great floods and all cultivation is very precarious: it is permanently settled with the Maharaja of Kapurthala. The rest of the *khadir* is of a much superior type; the land is fertile and is well cultivated from the homesteads lying on the high bank. It is at its best in a dry year and is not exposed to much danger from drought. Wet years on the other hand affect it very seriously: floods damage or destroy the kharif, and the soil gets waterlogged and gives very poor rabi crops. Landward this tract is bounded by sandy slopes of little value for cultivation but bearing fine groves of mangoes.

The Kaliani tract.—This tract lies south and west of the *khadir*: it includes, on the north of the Kaliani, Fatehpur, the west of Ramnagar, the south of Daryabad, Basrohi and nearly all Rudauli; on the south it includes the north of parganas Kursi, Dewa, Nawabganj, Partabganj and Surajpur. There is light loam and some *bhur* along the edge of the *khadir* and on both sides of the Kaliani, but the greater part of the tract is rich loam or clay. The distinguishing feature is the number of *jhils* spread all over the tract except close to the rivers.

Drainage is usually adequate as the *jhils*, though numerous, are not individually large and cause comparatively little damage: but the north of Kursi and Dewa and about half of Rudauli are liable to suffer seriously from waterlogging in wet years. Elsewhere the damage is local.

The Gumti tract.—This tract includes Haidargarh and Subeha on the south of the Gumti; and on the north, Mawai Maholara, south Surajpur, Siddhaur, Satrikh, and the south of parganas Partabganj, Dewa and Kursi. On the north the distinction between this and the Kaliani tract is not well-defined, but going southwards the soil becomes lighter, and the *jhils* become fewer and disappear altogether as the river is approached. The uplands are thoroughly drained with the exception of a few scattered villages, and the only real danger of flooding is where the valley of the Gumti opens out. The lowland along it is very fertile, but after heavy floods it is apt to get completely waterlogged and to go out of cultivation until the next dry season restores it.

There is a line of clay villages on the extreme south of Haidargarh and Subeha, a continuation of the northern clay tract of Rae Bareli; their drainage appears to be defective.

Water-supply.

The Kaliani tract in ordinary years draws most of its water from the *jhils*: when the rains cease early, a very large proportion of the tract can be protected by temporary wells, provided timely advances are given. The villages where such wells cannot be made are recorded in the well-survey: the principal defective areas are the north of Kursi, the land just above the *khadir* and parts of the north of Dewa. Masonry wells are rare in this tract, though their number has increased rapidly in recent years. Foundation-clay is by no means

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universal, but local information on the subject is incomplete: it appears to be absent along the edge of the *khadir*, and to be met with more frequently further south, but not in the vicinity of the Kaliani.

In the Gumti tract *jhils* are still an important resource, but a larger area is irrigated from wells. Temporary wells can usually be made: the villages where they are impossible are recorded in the well-survey. North of the Gumti masonry wells are still rare, and are not increasing rapidly, but south of the river the number is very large: thus in 1911 there was one such well to 63 acres of normal cultivation in Siddhaur, and to 19 acres in Haidargarh. Foundation-clay is ordinarily found except in the neighbourhood of the Gumti and its tributary streams. There appears to be some hostility to well-sinking on the part of landholders in this tract particularly in pargana Siddhaur, where the local officers who examined the well-survey considered that many more masonry wells are wanted. A similar need was found in Mawai Maholara, but not in other parganas.

Cattle-supply.

The stock of cows in the district is proportionately not large, and it is not concentrated near any large grazing area. But there are a good many villages, mainly in the Bara Banki and Ramsanehighat tahsils, where a considerable number of cows are owned by Ahirs, and it is remarkable that these owners seem to pay more attention to the calves and less to the milk than is usually the case in south Oudh; they may in fact almost be called small breeders. The cows are not a pure breed but approximate to the Kheri type: the supply of bulls for breeding is adequate.

The markets of the district serve to some extent as distributing centres: working cattle are brought in large numbers from Bahraich, Kheri and Sitapur, and sold to dealers from Fyzabad, Sultanpur and Azamgarh, who also occasionally buy

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locally raised stock. On balance the district is not self-supporting, but the two tahsils named are probably more nearly so than any part of south Oudh.

The district is liable to all the ordinary forms of cattle disease; rinderpest however has not been severe since 1900. The people were at first hostile to the practice of inoculation, but it is now welcomed.

Annals.

There are few records of agricultural vicissitudes before 1895 when the series of annual reports was begun. It is known vaguely that the drought of 1837 had serious results; and in 1878 there was some distress requiring relief, at first in the north of the district but later in tahsil Haidargarh.

The following information is gathered from the annual reports. The wet seasons from 1892 to 1894 were disastrous to the *khadir*, the inhabitants of which were much impoverished. The north of Kursi and parts of Rudauli also suffered from floods, while the productive power of the soil over most of the district appears to have been temporarily affected by the rise in the water-level. In 1894 the great flood on the Gumti threw the lowlands out of cultivation, and here as elsewhere along the river the injury appeared at the time to be permanent. The flood extended up the Kaliani and the villages on its banks were also much injured. In 1896 the rains ceased prematurely, and the rice crop, the principal kharif supply of food, was almost an entire failure: the failure was more severe in the south and west than in the east. Distress existed through the cold weather, being most severe in Kursi and in Haidargarh; but a large rabi was sown for 1897 everywhere except in Kursi and all crops except gram doing well; the distress had almost disappeared by May. It was noticed that the dry season brought great benefit to most of the waterlogged *khadir* and to the lowland along the Gumti. Enquiries were made during the year as to possibility of draining the wet parts of Rudauli and one project was carried out.

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Bara Banki.

From 1897 to 1902 the district was on the whole very prosperous. In 1901 the wheat suffered severely from rust, but other crops were good. In 1902 the Chauka shifted its course and caused a good deal of local injury in Muhammadpur, but the inhabitants of that part of the country rapidly accommodate themselves to such incidents which cannot be prevented.

The seasonal yields since 1903 are given in the following table :—

Year.	Rabi.				Kharif.				
	All crops.	Wheat.	Gram.	Poppy.	All crops.	Rice.	Sugarcane.	Small millets.	Pulses.
1903 ...	100	100	81	100	65	75	100	62	44
1904 ...	86	94	75	100	100	100	100	100	94
1905 ...	56	56	50	94	100	100	105	100	78
1906 ...	100	100	100	100	101	100	125	94	113
1907 ...	Not available	56	81	100	16	10	60	19	19
1908 ...	50	62	13	50	69	44	75	94	44
1909 ...	77	87	44	62	119	122	94	125	110
1910 ...	119	125	100	125	115	125	87	119	100
1911 ...	94	87	100	75	...	...	...	...	...

The rains of 1902 lasted well and enabled a large rabi to be sown for 1903: winter rains were light and unirrigated crops suffered slightly but other crops did exceedingly well. The monsoon was late and abnormal falls in October caused serious injury to all the late crops. An exceptionally large rabi area followed: wheat suffered slightly from rust, and gram was widely attacked by caterpillars. The rains of 1904 were satisfactory throughout and secured another large rabi area for 1905: but the crops suffered severe loss by the unusual frosts of February. As a consequence, the *zaid* area was three times the normal and the largest kharif area on record was sown. Both crops succeeded, though there were floods

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in the *khadir* in August. The rabi area of 1906 was slightly below the normal but the yield was good, and the following monsoon was also favourable despite exceptionally severe floods in the *khadir*. The rabi crops of 1907 suffered from excessive rain, wheat in particular being affected by rust.

The monsoon of this year began very late, and was practically confined to August. Most of the rice was lost and the yield was much the worst on record, while the rabi of 1908 was deficient in area by two-fifths and suffered from want of moisture and from dry winds in March. Distress was severe during these seasons: regular works were opened in February and relief continued until August. The relief given reached a maximum in March, but after falling at the rabi harvest increased again until a higher maximum was reached in the beginning of July: the numbers relieved exceeded five per cent. of the population. The north of the district was most affected, owing to the difficulty of sinking temporary wells.

The rains of 1908 were late but at first favourable, and the early crops were good: September was however too dry for the later crops, and the rabi area of 1909 was very small. Winter rains were inadequate and the crops suffered for want of moisture. The rains of this year were satisfactory and the crops were magnificent, but floods were severe in the *khadir*. The rabi of 1910 was sown on a substantially increased area: the winter rains were timely and not prolonged, and excellent crops were secured. The following rains were equally favourable, and their prologation enabled a normal rabi to be sown for 1911. Damp weather in February and March brought rust on wheat and injured poppy somewhat severely but the harvest was still satisfactory.

Progress.

The cultivated area increased substantially between the settlement of 1892—1896 and 1902, but the settlement areas were low, and the established increase over 1891-92 is very slight;

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apparently the limit of expansion has been reached. The proportion of land devoted to remunerative crops is high for south Oudh and shows a distinct tendency to increase. The sugarcane area has been better maintained than in the neighbouring districts, and wheat has extended progressively. Poppy is locally a very important crop, occupying 24,000 acres in 1911, and a large reduction in this area would be greatly felt by particular villages.

The number of masonry wells increased by 28 per cent. between 1905 and 1911: construction was active during the famine, but the impetus seems to have worn out as the increase in 1911 was only 72. The exceptional position of the district is shown by the fact that in 1911 there was only one masonry well to 60 acres of normal cultivation as against 39 acres in Lucknow on the west and 20 acres in Fyzabad on the east.

The population of the district increased substantially between 1891 and 1901, but there has been a heavy fall in the last decade: in 1911 it stood at 1,084,000 as against 1,131,000 in 1891.

Agricultural wages do not appear to have risen in the last five years: the rates recorded in 1911 lay between 1½ and 2 annas.

Advances for land improvement were taken in this district on a moderate scale (about Rs. 6,000 annually), between 1892 and 1899: from 1899 to 1906 the distribution was trifling, but in the famine year loans were taken on a very large scale. Since then demand has been more active, and in the last three years advances have averaged over Rs. 18,000. Loans for temporary purposes are freely taken in unfavourable seasons. There has been no development of agricultural co-operation in this district; a large agricultural bank was started but it was dissolved in consequence of its failure to adopt co-operative principles.

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Bara Banki.

The construction of the metre-gauge line from Gonda to Cawnpore, and especially the opening of the Elgin bridge over the Gogra, have greatly facilitated traffic with north Oudh, while the new branch line from Burhwal to Sitapur should be of material benefit to the north-west of the district. The length of metalled roads has been increased by nearly 100 miles since 1891, and in present conditions no large extensions are required.

The rise in rents has been rapid during recent years. The recorded rents in 1896, the first year after the settlement, gave a rate of Rs. 6·9 per acre, and the rate has risen to Rs. 8·3 in 1911 : this figure is approached only by Lucknow of the Oudh districts.

Handloom weaving is still widely carried on in the district, but the industry has suffered heavily from competition, and sugar-refining has declined owing to the same cause. The wood-working industry at Bahramghat is of some little importance : the only other modern form of industry is the factory for manufacturing sugarcane mills at the same place. This factory does not usually sell its mills but hires them out by the season over an area extending from Azamgarh to Kheri.

The district draws a smaller income from external sources than Fyzabad or Rae Bareli, but the receipts are important, and are extending steadily. At the end of the last century about six lakhs of rupees were distributed annually in money-orders : the amount had risen to over eight lakhs before the famine, and in the financial year 1908-9 rose further to 11½ lakhs. In each of the last two years it has been 10¼ lakhs, a fact which indicates that the new sources of income developed during the famine have been largely maintained.

Dangers and possible remedies or improvements.

1. The area sown with kharif crops depends mainly on the weather during the first month of the season counting

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from the first heavy fall of rain. An early beginning is an advantage, but the most important point is that there should be bright weather with just sufficient rain to enable tillage and sowing to proceed without interruption. If the first month is wet, sowings of dry crops will be delayed and the area will fall, though the loss may be to some extent made good by larger sowings of rice and also of *bajra* and the late pulses, which can be sown until nearly the end of August.

The small area under late rice depends chiefly on the weather during the second month: frequent falls of rain are required at this time, and a prolonged break will reduce the area.

The area planted with sugarcane is influenced by the weather in February and March, at which time rain facilitates tillage: but it is determined mainly by economic causes. One of these is the yields and prices obtained from the crop in recent seasons; the other is the financial position of the cultivators, which depends mainly on the success or failure of the preceding harvest.

2. The yield of the early dry crops, which cover over one-third of the kharif area, depends mainly on the weather during the first two months of the season: alternations of rain and bright weather are desirable, and the yield may be much reduced by excessive rain in the second month. The early rice, which covers about the same area, requires more rain, and is not likely to give a full yield when the dry crops do best.

The late dry crops require the prolongation of the rains almost to the end of September: they may be seriously injured by heavy falls in the end of September or the beginning of October, while they will give very little grain if September is altogether dry.

The small area under late rice requires more rain in September than is suitable for the dry crops, and at least one fall in October is desirable for its complete success.

Sugarcane is apt to suffer seriously at two periods. The first is the end of the hot weather: the crop benefits from an early commencement of the rains and suffers from delay. The second is the end of the rains: a premature cessation is most injurious, and rain in October is beneficial. The crop can stand a considerable excess of rain, but prolonged breaks are likely to cause injury.

The balance of cropping is fairly satisfactory, though from the nature of the soil the area under rice is so large that there must always be anxiety until this crop has matured.

3. Apart from variations in the rainfall, the only danger to kharif crops recorded is from floods, which affect the *khadir* and the lowlying areas on the Gumti: an exceptionally heavy flood on the Gumti may cause flooding along the Kaliani.

It is noteworthy that injury from the cane-hopper has not been reported in this district, and it is unlikely to occur in those localities where the people adhere to the practice of digging the field as soon as the cane is cut.

Injury caused by other insects has not been reported but should be watched for.

4. The rabi area depends on the rainfall during September and early October: late falls secure a considerable extension by enabling the rice-fields to be sown with a second crop, while an early cessation of the rains tends to produce a decrease considerably greater than occurs in the adjoining districts south of the Gogra. An examination of the statistics of border parganas indicates that the district fares worse in such seasons than its immediate neighbours, and the only explanation apparent in the figures is the scarcity of masonry wells which limits the possibility of *paleo* irrigation.

5. When the seed-bed has been sufficiently moist, the yield of the rabi does not depend largely on winter rains: these are however beneficial up to nearly the end of January, provided the falls are moderate and of short duration. Rain

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later in the season will ordinarily do harm, while prolonged periods of damp and cloudy weather in January and February must be expected to produce rust on wheat and linseed: the injury caused may be very serious, and its extent may not be fully realised until the crops are harvested.

When the ground has been dry at sowing time, and sowings have been largely made with irrigation, an early fall of winter rain is of great importance. When there is little winter rain or when falls are delayed, the crops fall off in condition as they ripen, and tend to wither under the strong dry winds which in such seasons must be expected in the spring. It is noteworthy that gram as a rule suffers most in this case: a seed-bed prepared with irrigation is less suitable for it than for the cereals or peas.

6. Frost occurring early in January does little harm except to the *arhar*; late frost may however cause very serious injury, and probably the end of January or the first week in February is the most dangerous period.

Hailstorms are of little importance until the cereals begin to ear: the danger from them increases as the season advances.

The rapeseed crop may be seriously injured by the aphis if damp and cloudy weather occurs while the plants are in flower.

The gram crop has occasionally suffered severely from caterpillars, but the conditions in which this becomes important are not accurately known.

Poppy may be seriously injured by damp and cloudy weather in March.

7. The *zaid* crops are of some importance in ordinary seasons, and when stocks of food are low the area increases largely owing to extended sowings of the hot-weather millet known in Oudh as *sawan*. The price of seed of this crop rises very high when the demand is large, and advances for

its purchase will probably be welcomed when the kharif yield has been bad or rabi prospects are unpromising.

8. A series of abnormal seasons of one type may produce certain cumulative effects. After some seasons of deficient rainfall the water-level falls, and the efficiency of temporary wells decreases, while the cost and labour of irrigation are materially enhanced. It is possible that the lowering of the water-level may proceed so far as to render the masonry wells useless in some tracts; but this has not yet been reported.

On the other hand a series of wet years may raise the water-level to a point where the productivity of the land declines. This may happen throughout the district, but its effects will be most noticeable in the Gumti lowlands, the *khadir*, and portions of Kursi, Dewa and Rudauli.

9. Distress requiring some measures of relief must be expected to occur when the winter rains have ceased by the beginning of September. The north of the district, especially pargana Kursi, has as a rule suffered most in seasons of scarcity but parts of tahsil Haidargarh have also been severely affected. In 1907-8, when distress was acute in the north, the following measures were taken :—

Revenue suspended, kharif ...	... 4⅓ lakhs.
" " rabi ...	... 4½ "
Improvement loans	... 3¾ "
Advances for rabi	... 6¾ "
" " kharif ...	... 2 "
" to agricultural bank	... ½ lakh.

Maximum proportion of population relieved 5·2 per cent. in June.

10. A serious shortage of fodder may occur in seasons when the rains have ceased so early that the later crops wither altogether or are seriously stunted in growth: in this case the only remedy that can be suggested is the importation of grass from the forests and its distribution on the *takavi*-system. The demand will depend very largely on the winter rains: if there are none, it may become very great, but even

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light falls bring up enough grass to keep large numbers of cattle going.

A fodder famine does not necessarily occur when the large millets yield no grain, as the plants may have grown to a sufficient size to yield fodder; but in such seasons juar occasionally becomes poisonous and the loss of cattle due to this cause may be considerable. The poison is formed under the abnormal conditions of growth, and its presence cannot be recognised beforehand except by analytical methods: the only action possible is to provide advances to enable cultivators to replace cattle that have died from this cause.

11. The question of improving the water-supply is most important: the district north of the Gumti falls far behind the rest of south Oudh in the equipment of masonry wells, and the need for these is actually felt in dry seasons: but on the other hand the facilities for *jhil* irrigation in ordinary seasons have in the past deterred the people from undertaking construction. Many more wells are undoubtedly needed for protection, and all possible facilities should be given for their construction: loans should be readily granted, a boring staff should be maintained to locate sites, and endeavours should be made to influence those landholders who are at present hostile to construction.

There may also be some scope for embankments in the rice tracts (vide Provincial Note, section III).

12. There is at present no demand for drainage works, but the question may become important in Kursi, Dewa and Rudauli if a series of wet seasons should recur. These parganas, and also the *khadir* and the Gumti lowlands, will in any case require watching in such seasons, and any decline in cultivation should be taken as indicating that a temporary adjustment of the revenue may be required.

13. To minimise losses from cattle disease, it is important that sustained attention should be given to the system of

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reporting outbreaks prescribed in the Land Records Manual, and that the local veterinary staff should be sufficient to localise outbreaks when they occur.

14. While the cultivators on a few of the large estates are financed by their landholders, the supply of capital is quite insufficient in the district generally, and there is an extensive scope for the working of the *takavi*-system. Improvement loans may be wanted for masonry wells and for embankments in rice tracts: agricultural loans may be required in the following circumstances:—

(*a*) *Early cessation of the rains.*—Advances will be required on a very large scale for the rabi, and probably also for the following kharif, while a smaller demand may arise about February for sugarcane and *zaid* crops. Advances to buy fodder may also be required.

(*b*) *Floods.*—Advances may be required to sow rabi in the tracts indicated above as liable to floods.

(*c*) *Cattle disease.*—It is important that cultivators should be able to replace working-stock before the beginning of the next tillage-season.

(*d*) *Curtailment of the poppy area.*—In this case it may be desirable to offer advances in villages where the crop has been largely grown to enable cultivators to substitute some other remunerative crop.

15. There is at present no general organisation which could introduce agricultural improvements requiring associated action, but possibly something could be done on a few of the larger estates. The seed stocks of the district require examination before recommendations can be made for their improvement. The Kurmi cultivators are exceptionally skilful and would probably welcome any new crop not requiring a

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large capital. The scope for expensive machinery is not great, but a demand may arise for power-pumps on the *jhils*; the cheaper forms of improved tillage implements will probably become popular by degrees.

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